

A1-F18AC-LMM-040

1 June 1993

Change 5 - 1 July 2002

TECHNICAL MANUAL

ORGANIZATIONAL MAINTENANCE

LINE MAINTENANCE

BORESIGHTING DATA

NAVY MODEL

F/A-18A/B/C/D

161353 AND UP

This issue includes IRAC 2.

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NATEC ELECTRONIC MANUAL

A1-F18AC-LMM-040

Change 5 - 1 July 2002

Page A

NUMERICAL INDEX OF EFFECTIVE WORK PACKAGES/PAGES

List of Current Changes

Original0.....1 Jun 93	Change11 Apr 94	Change.....2.....1 Jan 95
Change.....3.....1 Jun 95	Change.....4.....1 Nov 97	
Change5.....1 Jul 02	(IRAC 2 Inc.)	

Only those work packages/pages assigned to the manual are listed in this index. Insert Change 5, dated 1 July 2002. Dispose of superseded work packages/pages. Superseded classified work packages/pages shall be destroyed in accordance with applicable security regulations. If changed pages are issued to a work package, insert the changed pages in the applicable work package. The portion of text affected in a change or revision is indicated by change bars or the change symbol "R" in the outer margin of each column of text. Changes to illustrations are indicated by pointing hands, change bars, or MAJOR CHANGE symbols. Changes to diagrams may be indicated by shaded borders.

Total number of pages in this manual is 470 consisting of the following:

WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number
Title	5	001 00		2.....	5
A.....	5	1.....	5	3.....	5
B.....	5	2.....	5	4.....	5
C.....	5	001 01		5.....	5
D.....	5	1.....	4	6.....	5
E.....	5	2.....	4	7.....	5
F.....	5	3.....	4	8.....	5
G blank	5	4 blank	4	9.....	5
TPDR-1.....	5	002 00		10.....	5
TPDR-2 blank	5	1.....	5	11.....	5

A1-F18AC-LMM-040

Change 5 - 1 July 2002

Page B

WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number
12.....	5	25.....	0	21.....	0
13.....	5	26.....	0	22.....	0
14.....	5	27.....	0	23.....	0
15.....	5	28.....	0	24.....	0
16 blank	5	29.....	0	25.....	0
003 00		30.....	0	26.....	0
1.....	4	31.....	0	27.....	0
2 blank	4	32.....	0	28.....	0
003 01		33.....	0	29.....	0
1.....	2	34.....	0	30.....	0
2.....	0	35.....	0	31.....	0
3.....	1	36.....	0	32.....	0
4.....	0	003 02		33.....	1
5.....	0	1.....	2	34.....	1
6.....	0	2.....	0	003 03	
7.....	0	3.....	1	1.....	4
8.....	0	4.....	1	2.....	4
9.....	0	5.....	1	3.....	4
10.....	0	6.....	0	4.....	4
11.....	0	7.....	0	5.....	4
12.....	0	8.....	0	6.....	4
13.....	2	9.....	0	7.....	4
14.....	2	10.....	2	8.....	4
15.....	2	11.....	2	9.....	4
16.....	2	12.....	2	10.....	4
17.....	2	13.....	2	11.....	4
18.....	2	14.....	2	12.....	4
18A.....	2	15.....	2	13.....	4
18B blank	2	16.....	2	14.....	4
19.....	0	16A.....	2	15.....	4
20.....	0	16B blank.....	2	16.....	4
21.....	0	17.....	0	17.....	4
22.....	0	18.....	0	18.....	4
23.....	0	19.....	0	19.....	4
24.....	0	20.....	0	20.....	4

A1-F18AC-LMM-040

Change 5 - 1 July 2002

Page C

WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number
21.....	4	14.....	0	10.....	3
22.....	4	15.....	0	11.....	3
23.....	4	16.....	0	12.....	3
24.....	4	17.....	0	13.....	3
25.....	4	18.....	0	14.....	3
26.....	4	19.....	0	15.....	3
27.....	4	20.....	0	16.....	3
28.....	4	21.....	1	17.....	3
29.....	4	22.....	0	18.....	3
30.....	4	23.....	0	19.....	3
31.....	4	24.....	0	20.....	3
32.....	4	25.....	0	21.....	3
33.....	4	26.....	0	22.....	3
34.....	4	27.....	0	23.....	3
35.....	4	28.....	0	24.....	3
36.....	4	29.....	0	25.....	3
004 00		30.....	0	26.....	3
1.....	1	31.....	0	27.....	3
2 blank	1	32.....	0	28 blank	3
004 01		33.....	0	005 00	
1.....	1	34.....	0	1.....	1
2.....	1	35.....	0	2 blank	1
2A.....	1	36.....	0	005 01	
2B blank	1	37.....	0	1.....	1
3.....	1	38 blank	0	2.....	1
4.....	1	004 02		3.....	1
5.....	0	1.....	3	4.....	1
6.....	0	2.....	3	4A.....	1
7.....	1	3.....	3	4B blank	1
8.....	0	4.....	3	5.....	0
9.....	0	5.....	3	6.....	0
10.....	0	6.....	3	7.....	0
11.....	0	7.....	3	8.....	0
12.....	0	8.....	3	9.....	0
13.....	0	9.....	3	10.....	1

A1-F18AC-LMM-040

Change 5 - 1 July 2002

Page D

WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number
11.....	0	2 blank	0	9.....	0
12.....	0	006 01		10.....	0
13.....	0	1.....	1	11.....	0
14.....	0	2.....	1	12.....	0
15.....	0	3.....	0	13.....	0
16.....	0	4.....	0	14.....	0
17.....	0	5.....	0	15.....	0
18.....	0	6.....	0	16.....	0
19.....	0	7.....	0	17.....	0
20.....	0	8.....	0	18.....	0
21.....	0	9.....	0	19.....	0
22 blank	0	10.....	0	20.....	0
005 02		11.....	0	21.....	0
1.....	1	12.....	0	22 blank	0
2.....	1	13.....	0	007 00	
3.....	1	14.....	0	1.....	0
4.....	1	15.....	0	2 blank	0
5.....	1	16.....	0	007 01	
6.....	1	17.....	0	1.....	5
7.....	0	18.....	0	2.....	1
8.....	0	19.....	0	3.....	1
9.....	1	20.....	0	4.....	0
10.....	0	21.....	0	5.....	5
11.....	0	22.....	0	6.....	0
12.....	0	23.....	0	7.....	0
13.....	0	24 blank	0	8.....	0
14.....	0	006 02		9.....	0
15.....	0	1.....	1	10.....	0
16.....	0	2.....	0	11.....	0
17.....	0	3.....	1	12.....	0
18.....	0	4.....	1	13.....	0
19.....	0	5.....	0	14.....	0
20.....	0	6.....	0	15.....	0
006 00		7.....	0	16.....	5
1.....	0	8.....	0	17.....	0

A1-F18AC-LMM-040

Change 5 - 1 July 2002

Page E

WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number
18.....	0	4.....	0	14.....	0
19.....	0	5.....	0	15.....	0
20.....	0	6.....	0	16.....	0
21.....	0	7.....	0	17.....	0
22.....	0	8.....	0	18.....	0
23.....	0	9.....	0	19.....	0
24 blank	0	10.....	0	20.....	0
007 02		11.....	0	009 00	
1.....	5	12.....	0	1.....	3
2.....	0	13.....	0	2.....	3
3.....	1	14.....	0	3.....	3
4.....	1	15.....	0	4.....	3
5.....	5	16.....	0	4A.....	3
6.....	0	17.....	0	4B.....	3
7.....	0	18.....	0	5.....	0
8.....	0	19.....	0	6.....	1
9.....	0	20.....	0	7.....	0
10.....	0	21.....	0	8.....	0
11.....	0	22.....	0	9.....	0
12.....	0	23.....	0	10.....	0
13.....	5	24 blank	0	11.....	0
14.....	0	008 02		12.....	0
15.....	0	1.....	1	13.....	0
16.....	0	2.....	0	14.....	0
17.....	0	3.....	1	15.....	0
18.....	0	4.....	0	16.....	0
19.....	0	5.....	0	17.....	0
20 blank	0	6.....	0	18 blank	0
008 00		7.....	0	010 00	
1.....	0	8.....	0	1.....	0
2 blank	0	9.....	0	2 blank	0
008 01		10.....	0	010 01	
1.....	1	11.....	0	1.....	0
2.....	1	12.....	0	2.....	0
3.....	1	13.....	0	3.....	0

A1-F18AC-LMM-040

Change 5 - 1 July 2002

Page F/(G blank)

WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number
4.....	0	22.....	1		
5.....	0	23.....	1		
6.....	0	24.....	1		
7.....	0	25.....	1		
8.....	0	26.....	1		
9.....	0	27.....	1		
10.....	0	28.....	1		
11.....	0	29.....	1		
12.....	0	30.....	1		
13.....	0	31.....	1		
14 blank	0	32 blank	1		
010 02					
1.....	3				
2.....	1				
3.....	1				
4.....	1				
5.....	1				
6.....	1				
7.....	3				
8.....	3				
9.....	1				
10.....	1				
11.....	1				
12.....	1				
13.....	1				
14.....	1				
15.....	1				
16.....	3				
17.....	1				
18.....	1				
18A.....	3				
18B blank.....	3				
19.....	3				
20.....	1				
21.....	1				

A1-F18AC-LMM-040

Change 5 - 1 July 2002

TPDR-1

(TPDR-2 blank)

**LIST OF TECHNICAL PUBLICATION DEFICIENCY REPORTS
INCORPORATED**

ORGANIZATIONAL MAINTENANCE

LINE MAINTENANCE BORESIGHTING DATA

This WP supersedes TPDR WP, dated 1 November 1997.



1. The TPDRs listed below have been incorporated in this issue.

IDENTIFICATION NUMBER/ QA SEQUENCE NUMBER	LOCATION
NONE	

ALPHABETICAL INDEX**LINE MAINTENANCE****BORESIGHTING DATA**

This WP supersedes WP001 00, dated 1 November 1997.

Title	WP Number
Alignment Set Verification Procedure.....	010 00
Using 74D110021 Triaxial Alignment Set	010 01
Using 537226 Optical Alignment Set	010 02
Antenna, Radar Set	005 00
Using 74D110021 Triaxial Alignment Set	005 01
Using 537226 Optical Alignment Set	005 02
Boresight Reference Frame Assembly	009 00
Electrical Equipment Mounting Base	
Inertial Navigation Unit And Embedded GPS/INS	
(EGI) Unit.....	003 00
Using 74D110021 Triaxial Alignment Set	003 01
Using 537226 Optical Alignment Set	003 02
Embedded GPS/INS (EGI) Unit Using 537226 Optical	
Alignment Set.....	003 03
Forward Looking Infrared System Mount	007 00
Using 74D110021 Triaxial Alignment Set	007 01

Title	WP Number
Using 537226 Optical Alignment Set	007 02
Head-Up Display Unit and Assembly of HUD Electrical Equipment Mounting Base	004 00
Using 74D110021 Triaxial Alignment Set.....	004 01
Using 537226 Optical Alignment Set	004 02
Introduction.....	002 00
Effectivities.....	002 00
How To Use The Manual	002 00
Manual Issue Date.....	002 00
Manual References to IETM	002 00
Purpose.....	002 00
Quality Assurance Procedures	002 00
Record of Applicable Technical Directives.....	002 00
Requisition and Automatic Distribution of NAVAIR Technical Manuals	002 00
Technical Directives	002 00
Technical Publications Deficiency Report (TPDR)	002 00
Warnings, Cautions, and Notes	002 00
Laser Detector Tracker System Mount.....	008 00
Using 74D110021 Triaxial Alignment Set	008 01
Using 537226 Optical Alignment Set	008 02
Work Package Index	001 01
20MM Gun System.....	006 00
Using 74D110021 Triaxial Alignment Set	006 01
Using 537226 Optical Alignment Set	006 02

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****WORK PACKAGE INDEX**

This WP supersedes WP001 01, dated 1 April 1994.

WP Number	Title
001 00	Alphabetical Index
001 01	Work Package Index
002 00	Introduction
003 00	Electrical Equipment Mounting Base Inertial Navigation Unit And Embedded GPS/INS (EGI) Unit
003 01	Electrical Equipment Mounting Base (Inertial Navigation Unit) Using 74D110021 Triaxial Alignment Set
003 02	Electrical Equipment Mounting Base (Inertial Navigation Unit) Using 537226 Optical Alignment Set
003 03	Electrical Equipment Mounting Base Embedded GPS/INS (EGI) Unit Using 537226 Optical Alignment Set
004 00	Head-Up Display Unit and Assembly of HUD Electrical Equipment Mounting Base

WP Number	Title
004 01	Head-Up Display Unit and Assembly of HUD Electrical Equipment Mounting Base Using 74D110021 Triaxial Alignment Set
004 02	Head-Up Display Unit and Assembly of HUD Electrical Equipment Mounting Base Using 537226 Optical Alignment Set
005 00	Antenna, Radar Set
005 01	Antenna, Radar Set Using 74D110021 Triaxial Alignment Set
005 02	Antenna, Radar Set Using 537226 Optical Alignment Set
006 00	20MM Gun System
006 01	20MM Gun System Using 74D110021 Triaxial Alignment Set
006 02	20MM Gun System Using 537226 Optical Alignment Set
007 00	Forward Looking Infrared System Mount
007 01	Forward Looking Infrared System Mount Using 74D110021 Triaxial Alignment Set
007 02	Forward Looking Infrared System Mount Using 537226 Optical Alignment Set
008 00	Laser Detector Tracker System Mount
008 01	Laser Detector Tracker System Mount Using 74D110021 Triaxial Alignment Set
008 02	Laser Detector Tracker System Mount Using 537226 Optical Alignment Set
009 00	Boresight Reference Frame Assembly
010 00	Alignment Set Verification Procedure
010 01	Alignment Set Verification Procedure Using 74D110021 Triaxial Alignment Set

A1-F18AC-LMM-040

Change 4

001 01

Page 3/(4 blank)

**WP
Number**

010 02

Title

Alignment Set Verification Procedure
Using 537226 Optical Alignment Set

INTRODUCTION**ORGANIZATIONAL MAINTENANCE****LINE MAINTENANCE BORESIGHTING DATA**

This WP supersedes WP002 00, dated 1 November 1997.

**1. PURPOSE.**

2. This manual provides organizational level instructions to determine airframe boresight alignment using boresight equipment mounted to weapon replaceable assemblies (WRA) and Y128.500 bulkhead.
3. It is strongly recommended that all WRA mounts be verified each time the aircraft is boresighted. However, if time or personnel constraints do not allow boresight verification of all WRA mounts, boresight verification of individual mounts can be done.

4. HOW TO USE THE MANUAL.

5. Text and illustrations in this manual are in work package format. These work packages are complete sets of procedures arranged in logical sequence supplying instructions, references, and material/equipment requirements for boresighting WRA's. Work package types contained in this manual are listed below:

- a. Numerical Index of Effective Work Packages/Pages. This index (A Page) provides the user with the current status of the publication.

b. Technical Publication Deficiency Report (TPDR) Work Package. This work package lists deficiency reports incorporated into a specific manual during changes/revisions. This work package is numbered TPDR-1.

c. Alphabetical Index Work Package. This work package contains an alphabetical listing, by title, of each work package contained within the manual. This work package is numbered 001 00.

d. Work Package Index. This work package contains a listing of all WP numbers and their titles that have been assigned to the manual. This work package is numbered 001 01.

e. Introduction Work Package. This work package contains introductory information for boresighting personnel's use. This work package is numbered 002 00.

f. Specific Procedure Work Package. Specific procedure work packages are those which provide detailed procedures for boresighting WRA's. These work packages are numbered 003 00 through 010 02.

6. REQUISITION AND AUTOMATIC DISTRIBUTION OF NAVAIR TECHNICAL MANUALS.

7. Procedures to be used by Naval activities and other Department of Defense activities requiring NAVAIR technical manuals are defined in NAVAIR 00-25-100 and NAVAIRINST 5605.5.4A.

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10. MANUAL ISSUE DATE.

11. The date on the title page is the copy freeze date. No additions, deletions, or changes are made after the manual issue date except last minute safety of flight or required maintenance changes. Data collected after the manual issue date will be included in later changes or revisions of the manual.

12. TECHNICAL DIRECTIVES.

13. Technical directives are documents which provide instructions to add and record retrofit configuration modification or inspection instructions to delivered aircraft, or aircraft components.

14. AIRFRAME CHANGE (AFC) OR AIRBORNE SOFTWARE CHANGE (ASC). Technical directives which change configuration of aircraft structure or equipment installation, i.e. AFC, will list aircraft bureau numbers in effectivity notes and show before and after the AFC. Technical directives which change configuration of operational flight programs (OFP), i.e. ASC, will list the OFP CONFIG/IDENT NUMBER in effectivity notes and show the latest two authorized OFP programs. See AFC and ASC effectivity examples in Effectivity Note Example Table.

15. AIRCRAFT COMPONENT CHANGES. Technical directives which change configuration of aircraft components are listed below:

AAC	Aviation Armament Change for armament equipment
ACC	Aircrew System Change for aircrew survival equipment
AFC	Airframe Change for aircraft structure and equipment
ASC	Airborne Software Change for operational flight programs
AVC	Avionics Change for airborne electronic equipment, including wiring changes
AYC	Accessory Change for mechanical systems
PPC	Power Plant Change for engines

16. Component changes will list part numbers in the effectivities. See AVC effectivity examples in Effectivity Note Example table.

17. RECORD OF APPLICABLE TECHNICAL DIRECTIVES.

18. The technical directives affecting this manual are listed in the Record of Applicable Technical Directives of each affected work package. Because an ASC directs all aircraft be modified within 30 days, ASC's are not listed. When all affected aircraft are modified, the before configuration is removed from the manual, and the technical directive entry is removed from the Record of Applicable Technical Directives.

19. TECHNICAL PUBLICATIONS DEFICIENCY REPORT (TPDR).

20. The TPDR (OPNAV FORM 4790/66) is the form for reporting errors and suspected omissions in the technical manuals. The TPDR WP lists the TPDR's that are included in the current issue of the manual.

21. TPDR reporting procedures are in OPNAVINST 4790.2 SERIES.

22. QUALITY ASSURANCE PROCEDURES.

23. Procedures or parts of procedures which require quality assurance inspection are identified by the letters (QA) after the applicable steps. When (QA) is assigned to a step or a heading which is immediately followed by substeps, the inspection requirement is applicable to all substeps.

24. When doing maintenance in any area, a visual inspection of the area will be made for cracks, corrosion and security of component installation before securing the area for flight.

25. WARNINGS, CAUTIONS, AND NOTES.

26. Items of special importance and critical information are identified in warnings, cautions, and notes. Warnings and cautions appear

immediately before the step to which they apply. Notes may appear before or after the affected step.

WARNING

Warnings describe conditions or procedures that could result in injury or death if correct procedures are not followed.

CAUTION

Cautions describe conditions or procedures that could result in damage to or destruction of equipment if correct procedures are not followed.

NOTE

Notes describe or clarify conditions or procedures.

27. EFFECTIVITIES.

28. Effectivity notes on manual title pages, work package title pages, and within a work package indicate the aircraft or software program to which the data applies. If no effectivity note appears on the work package title page, the work package has the same effectivity as shown on the manual title page. The effectivity notes may use:

- a. Type, model, and series

NOTE

F/A-18D aircraft after bureau number 164967 was referred to as bureau number F/A-18D D-140. Now, F/A-18D aircraft after bureau number 164967 is 165409.

- b. Bureau number (tail number)
- c. Combination of type, model, series, and bureau numbers
- d. Part number or serial number
- e. Technical directive number
- f. Configuration/identification number

29. The table below shows examples of effectivity notes and their meanings:

Effectivity Note Examples

Effectivity Note	Definition
160777 AND UP	Applicable to all F/A-18A, F/A-18B, F/A-18C and F/A-18D for bureau numbers listed.
F/A-18A, F/A-18B	Applicable to all F/A-18A and F/A-18B.

Effectivity Note Examples (Continued)

Effectivity Note	Definition
F/A-18C, F/A-18D	Applicable to all F/A-18C and F/A-18D.
F/A-18A	Applicable to all F/A-18A, but not F/A-18B, F/A-18C and F/A-18D.
F/A-18B	Applicable to all F/A-18B, but not F/A-18A, F/A-18C, and F/A-18D.
F/A-18C	Applicable to all F/A-18C, but not F/A-18A, F/A-18B, and F/A-18D.
F/A-18D	Applicable to all F/A-18D, but not F/A-18A, F/A-18B, and F/A-18C.
F/A-18A, F/A-18C	Applicable to all F/A-18A and F/A-18C, but not to F/A-18B and F/A-18D.
F/A-18B, F/A-18D	Applicable to all F/A-18B and F/A-18D, but not to F/A-18A and F/A-18C.
F/A-18A 160775, 160777 THRU 160782	Only applicable to some bureau numbers of F/A-18A. Not applicable to any F/A-18B, even if a F/A-18B bureau number is within the numbers listed.

Effectivity Note Examples (Continued)

Effectivity Note	Definition
F/A-18C 163427, 163430 THRU 163456	Only applicable to some bureau numbers of F/A-18C. Not applicable to any F/A-18D, even if a F/A-18D bureau number is within the numbers listed.
F/A-18B 160784 AND UP	Only applicable to some bureau numbers of F/A-18B. Not applicable to any F/A-18A, even if an F/A-18A bureau number is within the numbers listed.
F/A-18D 163434 THRU 163457	Only applicable to some bureau numbers of F/A-18D. Not applicable to any F/A-18C, even if a F/A-18C bureau number is within the numbers listed.
F/A-18B 160784 AND UP, F/A-18D	Applicable to some bureau numbers of F/A-18B. Not applicable to any F/A-18A, even if an F/A-18A bureau number is within the numbers listed. Also applicable to all F/A-18D aircraft.
F/A-18C, F/A-18D 163434 THRU 163457	Applicable to all F/A-18C aircraft. Applicable to some bureau numbers of F/A-18D.

Effectivity Note Examples (Continued)

Effectivity Note	Definition
F/A-18D D-140 AND UP OR F/A-18D 165409 AND UP	Applicable to all F/A-18D aircraft after bureau number 164967.
160775 THRU 160785 BEFORE F/A-18 AFC 772	Applicable to F/A-18A and F/A-18B for bureau numbers listed, before modification by technical directive.
161213 AND UP; ALSO 160775 THRU 160785 AFTER F/A-18 AFC 772	Applicable to aircraft modified during production; also applicable when affected aircraft have been modified by technical directive.
160775 THRU 160785; WHEN NO. 2 CONTROL PANEL P/N XXXX-X IS INSTALLED	Applicable to F/A-18A and F/A-18B for bureau numbers listed if panel P/N XXXX-X is installed. (Configuration before AVC)
161213 AND UP; ALSO 160775 THRU 160785; WHEN NO. 2 CONTROL PANEL P/N XXXX-Y (AVC-102) IS INSTALLED	Applicable to aircraft modified during production; also applicable to aircraft components modified to the production configuration by technical directive. (Configuration after AVC)
P/N MBEU65101-9, MBEU65101-10 & MBEU65105-3	Applicable to assemblies which are interchangeable between aircraft.

Effectivity Note Examples (Continued)

Effectivity Note	Definition
ENGINE NO. 215101 THRU 215109	Applicable to assemblies which are interchangeable between aircraft, but configurations can not be identified by part number.
CONFIG/IDENT NUMBER 84A	The CONFIG/IDENT Number is the program load identification number which identifies the software program loaded in specific programmable units. Refer to A1-F18AC-SCM-000 for CONFIG/IDENT Number tables.

30. MANUAL REFERENCES TO IETM.

31. The manuals listed below have been converted into an Interactive Electronic Technical Manual (IETM) format. When an IETM is available, all references to the manuals below should be directed to the IETM.

PUBLICATION NUMBER	PUBLICATION NUMBER
A1-F18AC-120-100	A1-F18AC-440-300
A1-F18AC-120-200	A1-F18AC-450-100
A1-F18AC-120-300	A1-F18AC-450-200
A1-F18AC-120-310	A1-F18AC-450-300

PUBLICATION NUMBER	PUBLICATION NUMBER
A1-F18AC-130-100	A1-F18AC-510-100
A1-F18AC-130-200	A1-F18AC-510-200
A1-F18AC-130-300	A1-F18AC-510-300
A1-F18AC-130-310	A1-F18AC-560-100
A1-F18AC-130-320	A1-F18AC-560-200
A1-F18AC-240-100	A1-F18AC-560-300
A1-F18AC-240-200	A1-F18AC-570-100
A1-F18AC-240-300	A1-F18AC-570-200
A1-F18AC-270-100	A1-F18AC-570-210
A1-F18AC-270-200	A1-F18AC-570-220
A1-F18AC-270-210	A1-F18AC-570-300
A1-F18AC-270-300	A1-F18AC-570-310
A1-F18AC-270-310	A1-F18AC-570-600
A1-F18AC-410-100	A1-F18AC-600-100
A1-F18AC-410-200	A1-F18AC-600-200
A1-F18AC-410-300	A1-F18AC-600-300
A1-F18AC-410-310	A1-F18AC-730-100
A1-F18AC-420-100	A1-F18AC-730-200
A1-F18AC-420-200	A1-F18AC-730-300
A1-F18AC-420-300	A1-F18AC-742-100
A1-F18AC-420-310	A1-F18AC-742-200
A1-F18AC-440-100	A1-F18AC-742-300
A1-F18AC-440-200	A1-F18AC-743-100
A1-F18AC-743-200	A1-F18AC-SRM-420
A1-F18AC-743-300	A1-F18AC-SRM-430
A1-F18AC-744-100	A1-F18AC-SRM-440
A1-F18AC-744-200	A1-F18AC-SRM-500

PUBLICATION NUMBER	PUBLICATION NUMBER
A1-F18AC-744-300	A1-F18AE-120-100
A1-F18AC-745-100	A1-F18AE-120-200
A1-F18AC-745-200	A1-F18AE-120-300
A1-F18AC-745-300	A1-F18AE-460-100
A1-F18AC-750-100	A1-F18AE-460-200
A1-F18AC-750-200	A1-F18AE-460-210
A1-F18AC-750-300	A1-F18AE-460-300
A1-F18AC-770-100	A1-F18AE-460-310
A1-F18AC-770-200	A1-F18AE-460-320
A1-F18AC-770-300	A1-F18AE-460-330
A1-F18AC-FIM-000	A1-F18AE-580-100
A1-F18AC-FIM-010	A1-F18AE-580-200
A1-F18AC-LMM-000	A1-F18AE-580-300
A1-F18AC-LMM-010	A1-F18AE-630-100
A1-F18AC-LMM-030	A1-F18AE-630-200
A1-F18AC-LMM-040	A1-F18AE-630-300
A1-F18AC-PCM-000	A1-F18AE-740-100
A1-F18AC-PIM-000	A1-F18AE-740-110
A1-F18AC-PIM-010	A1-F18AE-740-200
A1-F18AC-SRM-200	A1-F18AE-740-210
A1-F18AC-SRM-250	A1-F18AE-740-220
A1-F18AC-SRM-300	A1-F18AE-740-230
A1-F18AC-SRM-310	A1-F18AE-740-300
A1-F18AC-SRM-410	A1-F18AE-741-100
A1-F18AE-741-200	A1-F18AE-WRM-010
A1-F18AE-741-300	A1-F18AE-WRM-020
A1-F18AE-760-100	A1-F18AE-WRM-100

PUBLICATION NUMBER	PUBLICATION NUMBER
A1-F18AE-760-200	A1-F18AE-WRM-200
A1-F18AE-760-300	A1-F18AE-WRM-300
A1-F18AE-FIM-100	A1-F18AE-WRM-800
A1-F18AE-FRM-000	A1-F18AF-WDM-000
A1-F18AE-MRC-000	A1-F18AF-WDM-010
A1-F18AE-MRC-250	A1-F18AF-WRM-000
A1-F18AE-MRC-300	A1-F18AF-WRM-010
A1-F18AE-SGF-000	A1-F18AG-731-100
A1-F18AE-SRM-600	A1-F18AG-731-200
A1-F18AE-SRM-601	A1-F18AG-731-300
A1-F18AE-SMR-610	A1-F18AG-745-100
A1-F18AE-SRM-611	A1-F18AG-745-200
A1-F18AE-SRM-650	A1-F18AG-745-300
A1-F18AE-SRM-651	A1-F18AG-746-100
A1-F18AE-SRM-660	A1-F18AG-746-200
A1-F18AE-SRM-661	A1-F18AG-746-300
A1-F18AE-SRM-662	A1-F18AG-LMM-050
A1-F18AE-SRM-700	A1-F18AH-710-100
A1-F18AE-SRM-710	A1-F18AH-710-200
A1-F18AE-SRM-750	A1-F18AH-710-300
A1-F18AE-SRM-760	A1-F18AH-740-100
A1-F18AE-WDM-000	A1-F18AH-740-110
A1-F18AE-WDM-010	A1-F18AH-740-200
A1-F18AE-WRM-000	A1-F18AH-740-210
A1-F18AH-740-220	
A1-F18AH-740-230	
A1-F18AH-740-300	

A1-F18AC-LMM-040

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PUBLICATION NUMBER	PUBLICATION NUMBER
A1-F18AH-742-100 A1-F18AH-742-200 A1-F18AH-742-300	

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****ELECTRICAL EQUIPMENT MOUNTING BASE****INERTIAL NAVIGATION UNIT AND EMBEDDED GPS/INS (EGI) UNIT**

This WP supersedes WP003 00, dated 1 June 1993.

Title	WP Number
Electrical Equipment Mounting Base	
Inertial Navigation Unit	
Using 74D110021 Triaxial Alignment Set	003 01
Using 537226 Optical Alignment Set	003 02
Embedded GPS/INS (EGI) Unit	
Using 537226 Optical Alignment Set	003 03

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****ELECTRICAL EQUIPMENT MOUNTING BASE****(INERTIAL NAVIGATION UNIT)****USING 74D110021 TRIAXIAL ALIGNMENT SET**

Reference Material

Line Maintenance Procedures	A1-F18AC-LMM-000
Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Inertial Navigation and Backup Attitude and Navigation Systems.....	A1-F18AC-730-300
Electrical Equipment Mounting Base	WP003 00
Inertial Navigation Unit.....	WP004 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	4
Aircraft Preparation.....	5

Alphabetical Index (Continued)

Subject		Page No.
Alignment Verification/Initial Alignment/Realignment		
Procedure.....		5
Introduction.....		2
General Instructions.....		3
Safety Precautions.....		4

Record of Applicable Technical Directives

None

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for boresighting the inertial navigation set electrical equipment mounting base (mount) located in avionics equipment bay door 13L. This procedure is used to determine the mount pitch, roll, and yaw attitude in relation to the boresight reference frame assembly inertial navigation set target point, and provides the step by step procedure for realigning the mount when out of tolerance. There are two tolerances, an alignment verification tolerance and an initial alignment/realignment tolerance. The alignment verification tolerance is used to determine if an in-service mount requires realignment. The initial alignment/realignment tolerance is used when initially aligning a new mount and when realigning an in-service mount that has exceeded the alignment verification tolerance.

3. GENERAL INSTRUCTIONS. To make sure the mount is accurately boresighted, the instructions below shall be used:

- a. Due to equipment sensitivity, boresighting should only be done ashore.
- b. Personnel must be familiar with the use and operation of the triaxial alignment set.
- c. Personnel must know the principles of boresighting.
- d. Boresighting should be done separately from other maintenance operations.
- e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
- f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.
- g. Attach bolts shall be clean and free of burrs and damaged threads.
- h. Visually inspect for loose or missing sealant around nuts on equipment.
- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

4. SAFETY PRECAUTIONS.**WARNING**

Laser radiation, do not look into laser beams or eye injury could occur.

- a. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

5. AIRCRAFT BORESIGHT REQUIREMENTS.

6. Aircraft structural flexing affects boresight accuracy. To control the affect of this flexing and to be sure the mount boresight is accurate, make sure the aircraft is as listed below:

- a. Forward fuselage:

- (1) Make sure all armament, avionics, electrical equipment, and/or ballast forward of the inertial navigation unit mount is installed.

- (2) Make sure ammunition drum is empty.

- (3) Make sure windshield is closed.

- (4) Make sure door 3 is closed (A1-F18AC-LMM-010).

- b. Cockpit(s): Make sure no personnel, tools and/or loose equipment are in cockpit.

- c. Center and aft fuselage. No preferred configuration is required for these areas.

d. External stores. No preferred configuration is required for these areas.

7. AIRCRAFT PREPARATION.

a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

8. ALIGNMENT VERIFICATION/INITIAL ALIGNMENT/REALIGNMENT PROCEDURE. See figure 1.

Support Equipment Required

Part Number or Type Designation	Nomenclature
74D110163-1001 (74D110023-1001)	Boresight Alignment Set (Inertial Measurement Unit Alignment Adapter)
74D110021-1003 (74D110021-1001)	Triaxial Alignment Set
-	Micrometer, 0 to 1 Inch
-	Torque Wrench, 0 to 200 Inch-Pounds

Materials Required

Specification or Part Number	Nomenclature
CCC-C-440 TYPE 1, CLASS 1	Cheesecloth
P-D-680, TYPE 2 950576	Dry Cleaning Solvent Shims

- a. Verify alignment of triaxial alignment set (WP010 01).
- b. Set up and install boresight reference frame assembly (BRFA), (WP009 00).
- c. Open door 13L (A1-F18AC-LMM-010).

NOTE

Do step d or e as applicable.

- d. When doing an alignment verification, remove inertial navigation unit, if installed (A1-F18AC-730-300, WP004 00).
- e. When doing an initial alignment, make sure the electrical equipment mounting base (mount) (2) is installed correctly and with a nominal thickness (0.1005 inch) of shims (24) between the mount (2) and shelf (25) (A1-F18AC-730-300, WP003 00).
- f. Make sure mount (2) attach bolts (22 and 23) are torqued 130 to 170 inch-pounds and bolt (21) is torqued 80 to 90 inch-pounds.

g. Install 74D111064 inertial measurement unit mount alignment adapter subassembly (IMU alignment adapter) (3) on mount (2) per substeps below:

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

(1) Clean mating surfaces of IMU alignment adapter (3) and mount using cheesecloth moistened with solvent. Make sure two guide pins (8) are clean and free of burrs and threads of self-locking swing bolts (9) are clean.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

(2) Position IMU alignment adapter (3) on the two mount guide pins (8).

(3) Swing self-locking bolts (9) up on the IMU alignment adapter.

(4) Make sure four alignment adapter mounting pads (10) are firmly seated against the four mount pads (11). See detail B.

NOTE

To prevent boresight errors, alternately handtighten swing bolts (9) an equal amount.

(5) Handtighten two swing bolts (9) until a clicking noise occurs from each bolt.

(6) After clicking noise occurs, alternately handtighten each swing bolt (9) one-half turn until each bolt is tightened one full turn. Do not overtighten.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

h. Clean attach bushing mating surfaces on IMU alignment adapter (3) and 74D111159 beam splitter (5) by wiping with clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

- i. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- j. Make sure attach bolts are clean and free of burrs and damaged threads.
- k. Lift beam splitter (5) by the box frame near the top and hold against IMU alignment adapter (3) attach bushings.
- l. Engage and snug two upper attach bolts first, then the lower attach bolt.
- m. Hand tighten all three attach bolts (12) the same amount.
- n. Install 74D111180 laser (4) on cone bolts in IMU alignment adapter (3) per substeps below:
 - (1) Wipe all oil and fingerprints from steel tube using clean cheesecloth.
 - (2) Open two laser clamps (13).
 - (3) Slide laser (4) forward into IMU alignment adapter until line on laser plate is aligned with aft edge of IMU alignment adapter.
 - (4) Rotate laser (4) to align line on laser plate with up mark on IMU alignment adapter.

(5) Close two laser clamps (13).

NOTE

Misalignment of lines can degrade boresight accuracy.

(6) Verify that line on laser plate is still aligned with mark on IMU alignment adapter.

NOTE

Failure to hook chain may degrade boresight accuracy.

(7) Hook chain (26) to loop on underside of IMU alignment adapter to support laser cable.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

o. Clean mating surfaces on 74D111167 triaxial detector unit (TDU) (7) and boresight reference frame assembly (BRFA) using cheesecloth moistened with solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

- p. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- q. Make sure attach bolts are clean and free of burrs and damaged threads.
- r. Lift the TDU (7) by its carrying handle, hold against BRFA (1) at inertial navigation set target point.
- s. Engage and snug two upper attach bolts first, then the lower attach bolt.
- t. Hand tighten all three attach bolts (15) the same amount.

NOTE

Failure to hook chain may degrade boresight accuracy.

- u. Hook chain (14) on BRFA to support cable.

WARNING

Laser radiation, do not look into laser beam or eye injury could occur.

NOTE

The main laser light will illuminate when control/display unit (6) is turned on. When laser energy is not sensed by the TDU after approximately 15 seconds, it will inhibit the laser, causing the main laser light to go off.

- v. Press control/ display unit switch (17) to ON position.

NOTE

The mount pitch, roll, and yaw indications are displayed on the control/display unit. The PITCH, ROLL, and YAW displays are graduated in 0.01 milliradian increments. Because of equipment sensitivity, five indications should be taken, then use the average of these indications for alignment correction.

Normal equipment operation will allow the displayed ROLL reading to fluctuate as much as ± 0.50 milliradians about a median value. Operator judgement should be used to determine this median roll value.

w. Determine boresight reading:

(1) Read and record plus-minus PITCH (18) and YAW (19) display indications to the nearest 0.1 milliradian.

(2) Release swing-bolts (9) securing IMU mount alignment adapter (3) to electrical equipment mounting base (2).

(3) Read and record plus-minus ROLL (20) display indications to the nearest 0.1 milliradian.

(4) Reinstall swing-bolts (9) per steps g(3) thru g(6).

x. Push control/display unit switch (17) to off position.

NOTE

There are two tolerances, an alignment verification tolerance and an initial alignment/realignment tolerance.

y. Determine if the mount pitch, roll, and yaw indications, recorded in step w, are within the applicable alignment tolerance per substeps below:

(1) Alignment verification tolerance (existing mount).

(a) Pitch: When the pitch is 0.0 ± 1.0 milliradian, the mount pitch is within tolerance.

(b) Roll: When the roll is 0.0 ± 1.0 milliradians, the mount roll is within tolerance.

(c) Yaw: When the yaw is 0.0 ± 1.0 milliradians, the mount yaw is within tolerance.

(2) Initial alignment/realignment tolerance (new or reinstalled mount).

(a) Pitch: When the pitch is 0.0 ± 0.5 milliradian, the mount pitch is within tolerance.

(b) Roll: When the roll is 0.0 ± 0.5 milliradian, the mount roll is within tolerance.

(c) Yaw: When the yaw is 0.0 ± 0.5 milliradian, the mount yaw is within tolerance.

z. If the mount pitch, roll, and yaw are within the applicable tolerance, go to step ac. If the mount pitch and/or roll are not within tolerance, go to step aa. If only yaw is not within tolerance, go to step ab.

NOTE

When the mount pitch and/or roll are not within tolerance, realign the mount in PITCH, then ROLL, then YAW to get the best possible alignment. The mount is aligned by changing the shim thickness between the mount and shelf. Two sets of shims will be required.

aa. When the mount (2) is out of pitch and/or roll alignment tolerance, realign the mount per substeps below:

NOTE

If indication is greater than listed, add indications as needed for required shim thickness.

- (1) Using the conversion values in Table 1, convert the pitch indication, recorded in step w(1), to inch of shim adjustment and record.
- (2) Using the conversion values in Table 2, convert the roll indication, recorded in step w(3), to inch of shim adjustment and record.
- (3) Loosen, but do not remove, the mount (2) inboard pivot attach bolt (21).
- (4) Remove the mount forward attach bolt (23) and remove shims (24) from between mount and shelf. Using a micrometer, measure and record existing shim (24) thickness at forward attach point.

(5) Remove the mount aft attach bolt (22) and remove shims (24) from between mount and shelf. Using a micrometer, measure and record existing shim (24) thickness at aft attach point.

(6) Determine shim (24) thickness required at forward attach bolt (23) per applicable substeps below:

(a) If step w(1) pitch indication is positive, subtract data recorded in substep aa(1) from existing shim thickness recorded in substep aa(4) and record.

(b) If step w(1) pitch indication is negative, add data recorded in substep aa(1) to existing shim thickness recorded in substep aa(4) and record.

(c) If step w(3) roll indication is positive, subtract data recorded in substep aa(2) from data recorded in substep aa(6)(a) or aa(6)(b), as applicable, and record as shim thickness to be installed at forward attach bolt.

(d) If step w(3) roll indication is negative, add data recorded in substep aa(2) to data recorded in substep aa(6)(a) or aa(6)(b), as applicable, and record as shim thickness to be installed at forward attach bolt.

(7) Determine shim (24) thickness required at aft attach bolt (22) per applicable substeps below:

(a) If step w(1) pitch indication is positive, add data recorded in substep aa(1) to existing shim thickness recorded in substep aa(5) and record.

- (b) If step w(1) pitch indication is negative, subtract data recorded in substep aa(1) from existing shim thickness recorded in substep aa(5) and record.
- (c) If step w(3) roll indication is positive, subtract data recorded in substep aa(2) from data recorded in substep aa(7)(a) or aa(7)(b), as applicable, and record as shim thickness to be installed at aft attach bolt.
- (d) If step w(3) roll indication is negative, add data recorded in substep aa(2) to data recorded in substep aa(7)(a) or aa(7)(b), as applicable, and record as shim thickness to be installed at aft attach bolt.

(8) If shim thickness to be installed at either forward or aft attach bolt is less than 0.0 inch or more than 0.2005 inch, a depot engineering disposition is required.

(9) Using 950576 shims, and chart shown on figure, select combination of shims equal to shim thicknesses to be installed as determined in substep aa(6) and aa(7). For shim requisitioning (A1-F18AC-730-300, WP003 00).

(10) Prepare mount (2), shims (24), and shelf (25) for electrical bonding and sealing (A1-F18AC-LMM-000).

(11) Install shims (24), selected in substep aa(9), between mount (2) and shelf (25) at forward attach point. Install forward attach bolt (23) handtight.

(12) Install shims (24), selected in substep aa(9), between mount (2) and shelf (25) at aft attach point. Install aft attach bolt (22) handtight.

(13) Align the mount (2) yaw per substeps below:

WARNING

Laser radiation, do not look into laser beam or eye injury could occur.

- (a) Push control/display unit switch (17) to on position.
- (b) While monitoring the control/display unit (6) YAW display (19), shift the mount (2), forward or aft, until YAW display indicates 0.0 milliradians.
- (c) Torque mount attach bolts (22 and 23) 130 to 170 inch-pounds and bolt (21) 80 to 90 inch-pounds.

(14) Determine boresight reading:

- (a) Read and record plus-minus PITCH (18) and YAW (19) display indications to the nearest 0.1 milliradian.
- (b) Release swing-bolts (9) securing IMU mount alignment adapter (3) to electrical equipment mounting base (2).
- (c) Read and record plus-minus ROLL (20) display indications to the nearest 0.1 milliradian.

(d) Reinstall swing-bolts (9) per steps g(3) thru g(6).

(15) Push control/display unit switch (17) to off position.

(16) Determine if the mount (2) pitch, roll, and yaw are within initial alignment/realignment tolerance per substeps below:

(a) Pitch: When the PITCH display indication, recorded in substep aa(14)(a), is 0.0 ± 0.5 milliradian, the mount pitch is within tolerance.

(b) Yaw: When the YAW display indication, recorded in substep aa(14)(a), is 0.0 ± 0.5 milliradian, the mount yaw is within tolerance.

(c) Roll: When the ROLL display indication, recorded in substep aa(14)(c), is 0.0 ± 0.5 milliradian, the mount roll is within tolerance.

(17) If the mount pitch, yaw, and roll are within tolerance, as determined in substep aa(16), go to step ac. If the mount pitch or roll is not within tolerance, repeat step aa, except use display indications recorded in substep aa(14) for substeps aa(1) and aa(2) conversion. If only the mount yaw is not within tolerance, go to step ab.

ab. When only mount (2) yaw is out of alignment tolerance, realign the mount yaw per substeps below:

(1) Loosen, but do not remove, mount (2) three attach bolts (21, 22, and 23).

WARNING

Laser radiation, do not look into laser beam or eye injury could occur.

(2) Push control/display unit (6) switch (17) to on position.

(3) While monitoring the control/display unit (6) YAW display (19), shift the mount (2), forward or aft, until the YAW display indicates 0.0 milliradian.

(4) Torque the mount attach bolts (22 and 23) 130 to 170 inch-pounds and bolt (21) 80 to 90 inch-pounds.

(5) If the YAW display is 0.0 ± 0.5 milliradian, the mount yaw is within tolerance. If not within tolerance, repeat step ab.

(6) Push control/display unit (6) switch (17) to off position.

ac. Remove TDU (7) from BRFA (1) and install on check fixture.

ad. Remove laser (4) from IMU alignment adapter (3) per substeps below:

(1) Unhook chain (26) from IMU alignment adapter (3).

(2) Open two laser clamps (13).

(3) Slide laser (4) aft out of IMU alignment adapter (3) and install on check fixture.

(4) Close two laser clamps (13).

ae. Remove beam splitter assembly (5) from IMU alignment adapter (3) by removing three attach bolts (12) and install on check fixture.

af. Remove IMU alignment adapter (3) from mount (2) per substeps below:

(1) Pull up on two swing bolt (9) knobs and turn counterclockwise until locking collar can be removed from IMU alignment adapter (3).

(2) Slide IMU alignment adapter (3) outboard off of two guide pins (8).

ag. Inspect door 13L area for foreign objects.

ah. Install inertial navigation unit (A1-F18AC-730-300, WP004 00).

ai. Close door 13L (A1-F18AC-LMM-010).

aj. If all boresighting is complete, remove and stow BRFA (WP009 00).

ak. If all boresighting is complete, remove safety devices, as required (A1-F18AC-PCM-000).

Table 1. Conversion of Control/Display Unit PITCH Indication to Shim Thickness Adjustment

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
0.1	0.0004
0.2	0.0009
0.3	0.0013
0.4	0.0017
0.5	0.0021
0.6	0.0025
0.7	0.0030
0.8	0.0030
0.9	0.0040
1.0	0.0040
1.1	0.0045
1.2	0.0050
1.3	0.0055
1.4	0.0060
1.5	0.0060
1.6	0.0065
1.7	0.0070
1.8	0.0075
1.9	0.0080
2.0	0.0085
2.1	0.0090
2.2	0.0090
2.3	0.0100

Table 1. Conversion of Control/Display Unit PITCH Indication to Shim Thickness Adjustment (Continued)

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
2.4	0.0100
2.5	0.0105
2.6	0.0110
2.7	0.0115
2.8	0.0120
2.9	0.0120
3.0	0.0125
3.1	0.0130
3.2	0.0135
3.3	0.0140
3.4	0.0145
3.5	0.0150
3.6	0.0150
3.7	0.0155
3.8	0.0160
3.9	0.0165
4.0	0.0170
4.1	0.0175
4.2	0.0180
4.3	0.0180
4.4	0.0185
4.5	0.0190
4.6	0.0195
4.7	0.0200
4.8	0.0200
4.9	0.0205

Table 1. Conversion of Control/Display Unit PITCH Indication to Shim Thickness Adjustment (Continued)

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
5.0	0.0210
5.1	0.0215
5.2	0.0220
5.3	0.0225
5.4	0.0230
5.5	0.0235
5.6	0.0235
5.7	0.0240
5.8	0.0245
5.9	0.0250
6.0	0.0255
6.1	0.0260
6.2	0.0260
6.3	0.0265
6.4	0.0270
6.5	0.0275
6.6	0.0280
6.7	0.0285
6.8	0.0290
6.9	0.0290
7.0	0.0295
7.1	0.0300
7.2	0.0305
7.3	0.0310
7.4	0.0315
7.5	0.0320

Table 1. Conversion of Control/Display Unit PITCH Indication to Shim Thickness Adjustment (Continued)

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
7.6	0.0325
7.7	0.0325
7.8	0.0330
7.9	0.0335
8.0	0.0340
8.1	0.0345
8.2	0.0350
8.3	0.0350
8.4	0.0355
8.5	0.0360
8.6	0.0365
8.7	0.0370
8.8	0.0375
8.9	0.0380
9.0	0.0380
9.1	0.0385
9.2	0.0390
9.3	0.0395
9.4	0.0400
9.5	0.0405
9.6	0.0410
9.7	0.0410
9.8	0.0415
9.9	0.0420
10.0	0.0425

Table 2. Conversion of Control/Display Unit ROLL Indication to Shim Thickness Adjustment

ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
0.1	0.0008
0.2	0.0015
0.3	0.0023
0.4	0.0030
0.5	0.0038
0.6	0.0045
0.7	0.0053
0.8	0.0060
0.9	0.0068
1.0	0.0075
1.1	0.0080
1.2	0.0090
1.3	0.0095
1.4	0.0105
1.5	0.0110
1.6	0.0120
1.7	0.0125
1.8	0.0135
1.9	0.0140
2.0	0.0150
2.1	0.0155
2.2	0.0165
2.3	0.0170
2.4	0.0180
2.5	0.0185
2.6	0.0195

Table 2. Conversion of Control/Display Unit ROLL Indication to Shim Thickness Adjustment (Continued)

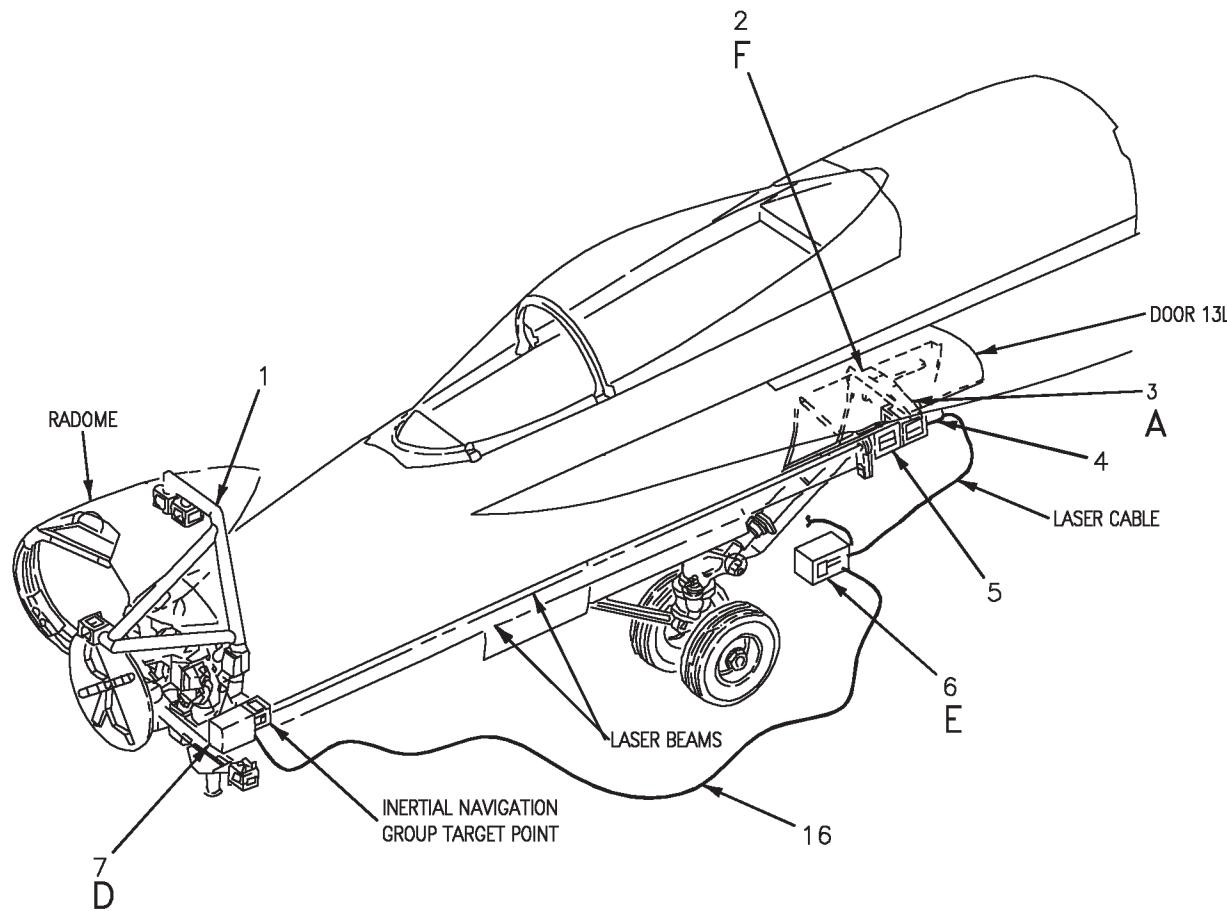
ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
2.7	0.0200
2.8	0.0205
2.9	0.0215
3.0	0.0225
3.1	0.0230
3.2	0.0240
3.3	0.0245
3.4	0.0255
3.5	0.0260
3.6	0.0270
3.7	0.0275
3.8	0.0285
3.9	0.0290
4.0	0.0300
4.1	0.0305
4.2	0.0315
4.3	0.0320
4.4	0.0330
4.5	0.0335
4.6	0.0345
4.7	0.0350
4.8	0.0360
4.9	0.0365
5.0	0.0375
5.1	0.0380
5.2	0.0390

Table 2. Conversion of Control/Display Unit ROLL Indication to Shim Thickness Adjustment (Continued)

ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
5.3	0.0395
5.4	0.0405
5.5	0.0410
5.6	0.0420
5.7	0.0425
5.8	0.0435
5.9	0.0440
6.0	0.0450
6.1	0.0455
6.2	0.0465
6.3	0.0470
6.4	0.0480
6.5	0.0485
6.6	0.0495
6.7	0.0500
6.8	0.0510
6.9	0.0515
7.0	0.0525
7.1	0.0530
7.2	0.0540
7.3	0.0550
7.4	0.0555
7.5	0.0560
7.6	0.0570
7.7	0.0580
7.8	0.0585

Table 2. Conversion of Control/Display Unit ROLL Indication to Shim Thickness Adjustment (Continued)

ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
7.9	0.0590
8.0	0.0600
8.1	0.0610
8.2	0.0615
8.3	0.0620
8.4	0.0630
8.5	0.0635
8.6	0.0645
8.7	0.0650
8.8	0.0660
8.9	0.0665
9.0	0.0675
9.1	0.0680
9.2	0.0690
9.3	0.0695
9.4	0.0705
9.5	0.0710
9.6	0.0720
9.7	0.0725
9.8	0.0735
9.9	0.0740
10.0	0.0750

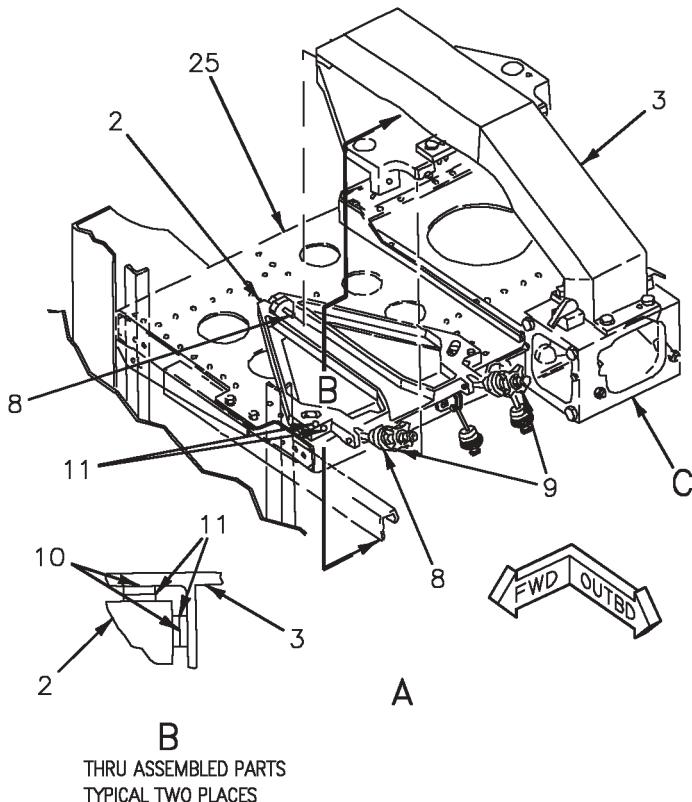


**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 1)**

Figure 1.

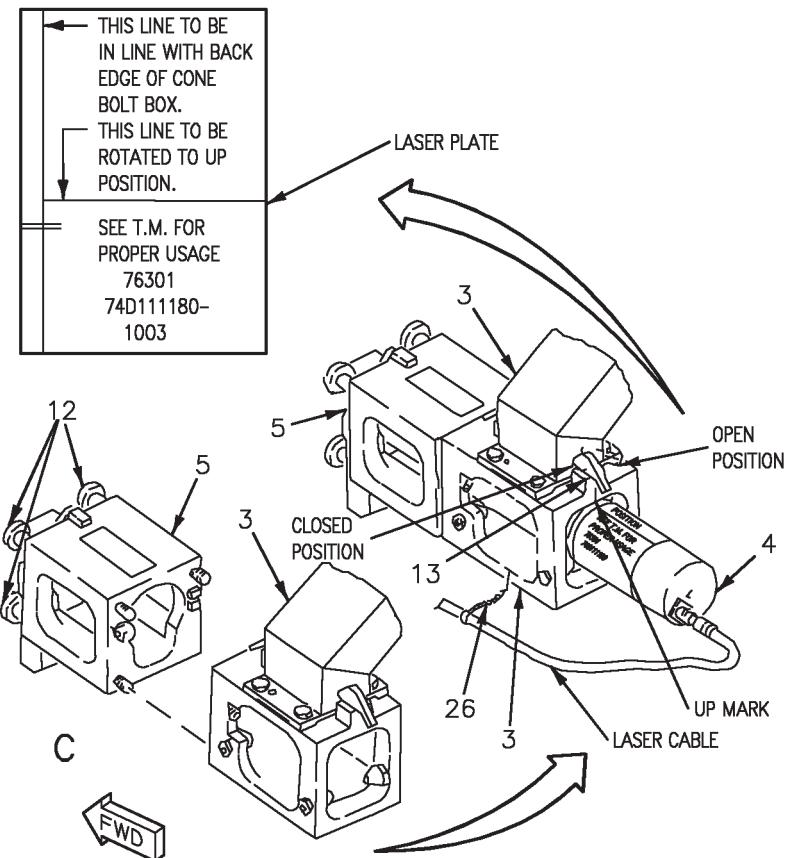
18AC-LMM-04-(6-1)11-SCAN

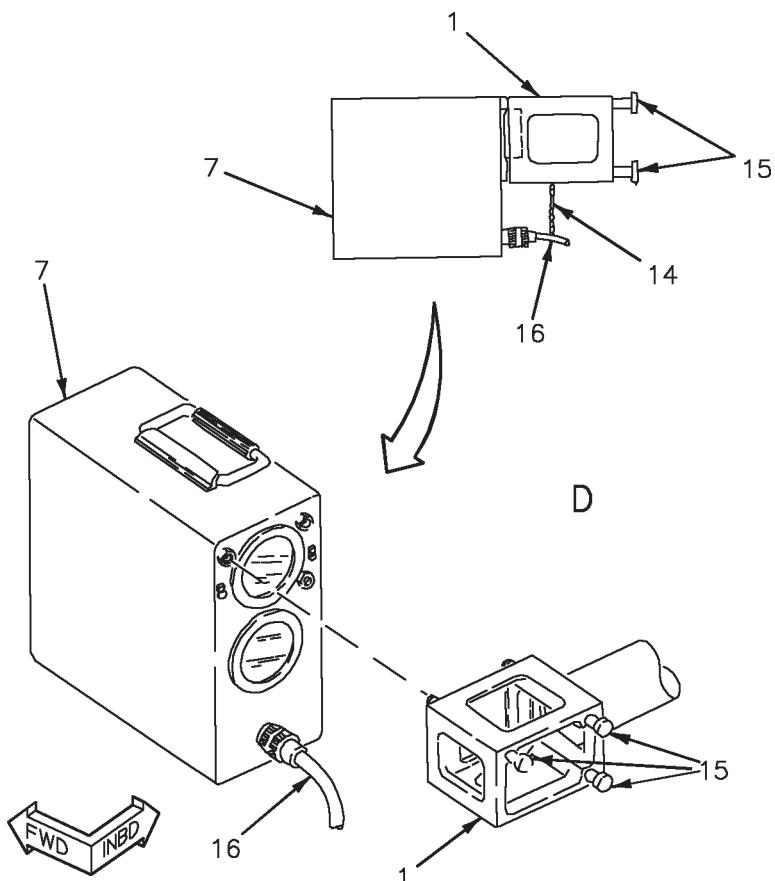
Figure 1.



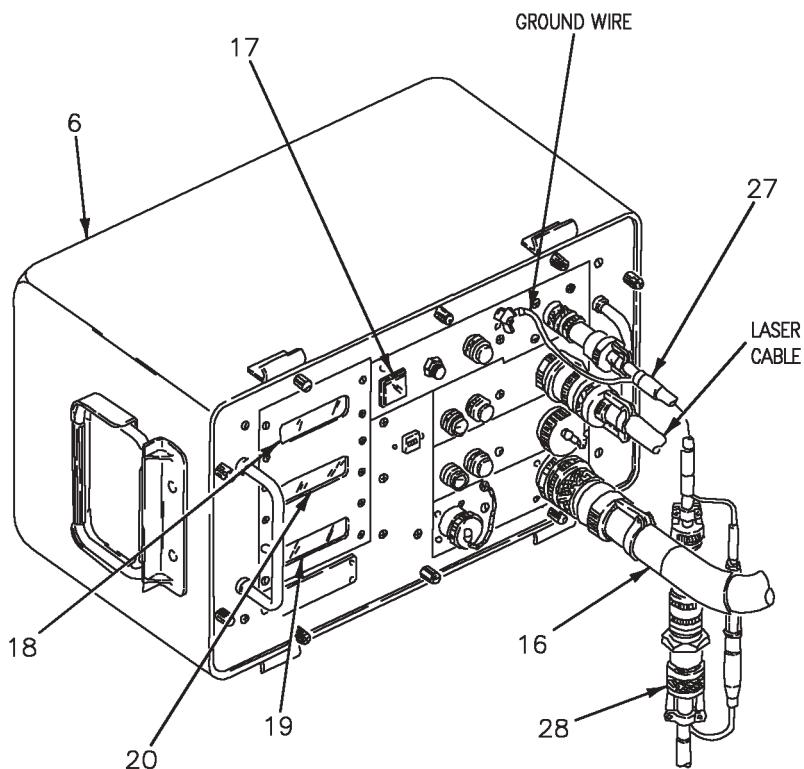
18AC-LMM-04-(6-2)11-SCAN

**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 2)**

**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 3)**

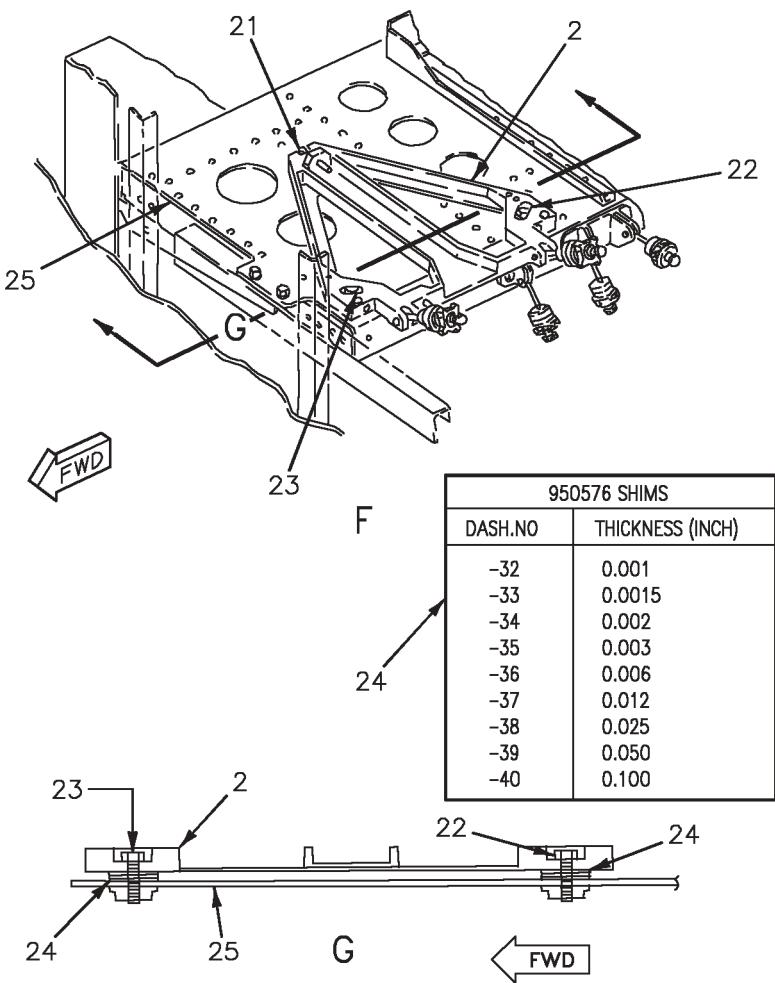


**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 4)**



18AC-LMM-04-(6-5)11-SCAN

**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 5)**



18AC-LMM-04-(6-6)11-SCAN

**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 6)**

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]▶	Boresight Reference Frame Assembly	74D111115
2	Electrical Equipment Mounting Base	—
3 [1]▶	Inertial Measurement Unit Mount Assy.	74D111064
4 [2]▶	Laser	74D111180
5 [2]▶	Beam Splitter Assembly	74D111159
6 [2]▶	Control/Display Unit	74D111141
7 [2]▶	Triaxial Detector Unit	74D111167
8	Guide Pin	—
9	Swing Bolt	—
10	Alignment Adapter Mounting Pad	—
11	Mount Pad	—
12	Attach Bolt	—
13	Laser Clamp	—
14	Chain	—
15	Attach Bolt	—
16 [2]▶	Cable	74D111145-1001
17	Switch	—
18	Pitch Display	—
19	Yaw Display	—
20	Roll Display	—
21	Inboard Pivot Attach Bolt	—
22	Aft Attach Bolt	NAS675V6
23	Forward Attach Bolt	NAS675V6
24	Shim	950576
25	Shelf	—
26	Chain	—

**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 7)**

INDEX NO.	NOMENCLATURE	PART NUMBER
27 [2]	Cable	74D111145-1003
28 [2]	Cable	74D111145-1005
LEGEND		
[1] Part of 74D110163 boresight alignment set.		
[2] Part of 74D110021 triaxial alignment set.		

**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 8)**

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****ELECTRICAL EQUIPMENT MOUNTING BASE****(INERTIAL NAVIGATION UNIT)****USING 537226 OPTICAL ALIGNMENT SET**

Reference Material

Line Maintenance Procedures	A1-F18AC-LMM-000
Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Inertial Navigation and Backup Attitude and Navigation Systems.....	A1-F18AC-730-300
Electrical Equipment Mounting Base	WP003 00
Inertial Navigation Unit.....	WP004 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	4
Aircraft Preparation.....	5

Alphabetical Index (Continued)

Subject	Page No.
Alignment Verification/Initial Alignment/Realignment	
Procedure.....	5
Introduction.....	2
General Instructions.....	3
Safety Precautions.....	4

Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
SEC 4998	—	Replacement of 74D110021 Triaxial Alignment Set With 537226 Optical Alignment Set. (Alameda ECP 775)	1 Jun 93	—

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for boresighting the inertial navigation set electrical equipment mounting base (mount) located in avionics equipment bay door 13L. This procedure is used to determine the mount pitch, roll, and yaw attitude in relation to the boresight reference frame assembly inertial navigation set target point, and provides the step by step procedure for realigning the mount when out of tolerance.

3. There are two tolerances, an alignment verification tolerance and an initial alignment/realignment tolerance.
 - a. The alignment verification tolerance is used to determine if an in-service mount requires realignment.
 - b. The initial alignment/realignment tolerance is used when initially aligning a new mount and when realigning an in-service mount that has exceeded the alignment verification tolerance.
4. **GENERAL INSTRUCTIONS.** To make sure the mount is accurately boresighted, the instructions below shall be used:
 - a. Due to equipment sensitivity, boresighting should only be done ashore.
 - b. Personnel must be familiar with the use and operation of the optical alignment set.
 - c. Personnel must know the principles of boresighting.
 - d. Boresighting should be done separately from other maintenance operations.
 - e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
 - f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.
 - g. Attach bolts shall be clean and free of burrs and damaged threads.
 - h. Visually inspect for loose or missing sealant around nuts on equipment.

- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

5. SAFETY PRECAUTIONS.

- a. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

6. AIRCRAFT BORESIGHT REQUIREMENTS.

7. Aircraft structural flexing affects boresight accuracy. To control the affect of this flexing and to be sure the mount boresight is accurate, make sure the aircraft is as listed below:

- a. Forward fuselage:

- (1) Make sure all armament, avionics, electrical equipment, and/or ballast forward of the inertial navigation unit mount is installed.

- (2) Make sure ammunition drum is empty.

- (3) Make sure windshield is closed.

- (4) Make sure door 3 is closed (A1-F18AC-LMM-010).

- b. Cockpit(s): Make sure no personnel, tools and/or loose equipment are in cockpit.

- c. Center and aft fuselage. No preferred configuration is required for these areas.

- d. External stores.

- (1) Pylons, weapon launcher and/or ejector racks may be installed on all stations and in any combination.

(2) Forward looking infrared system and laser detector-tracker-strike camera set are the only pods that may be installed.

(3) Make sure no weapons are installed.



8. AIRCRAFT PREPARATION.

a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

9. ALIGNMENT VERIFICATION/INITIAL ALIGNMENT/REALIGNMENT PROCEDURE. See figure 1.

Support Equipment Required

Part Number or Type Designation	Nomenclature
--	---------------------

74D110163-1001	Boresight Alignment Set
537226	Optical Alignment Set
—	Micrometer, 0 to 1 Inch
—	Torque Wrench, 0 to 200 Inch-Pounds

Materials Required**Specification
or Part Number****Nomenclature**

CCC-C-440 TYPE 1,
CLASS 1
P-D-680, TYPE 2
950576

Cheesecloth
Dry Cleaning Solvent
Shims

- a. Verify alignment of optical alignment set (WP010 02).
- b. Set up and install boresight reference frame assembly (BRFA) (1) (WP009 00).
- c. Open door 13L (A1-F18AC-LMM-010).

NOTE

Do step d or e as applicable.

- d. When doing an alignment verification, remove inertial navigation unit, if installed (A1-F18AC-730-300, WP004 00).
- e. When doing an initial alignment, make sure the electrical equipment mounting base (mount) (15) is installed correctly and with a nominal thickness (0.1005 inch) of shims (29) between the mount (15) and shelf (30) (A1-F18AC-730-300, WP003 00).
- f. Make sure mount (15) attach bolts (27 and 28) are torqued 130 to 170 inch-pounds and bolt (26) is torqued 80 to 90 inch-pounds.

g. Install 74D111064 inertial measurement unit mount alignment adapter subassembly (IMU alignment adapter) (16) on mount (15) per substeps below:

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

(1) Clean attach points on IMU alignment adapter (16) and mount (15) using clean cheesecloth moistened with solvent. Make sure two guide pins (19) are clean and free of burrs and threads of self-locking swing bolts (9) are clean.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

(2) Position IMU alignment adapter (16) on the two mount guide pins (19).

(3) Swing self-locking bolts (9) up on the IMU alignment adapter.

(4) Make sure four alignment adapter mounting pads (10) are firmly seated against the four mount pads (11). See detail B.

NOTE

To prevent boresight errors, alternately handtighten swing bolts (9) an equal amount.

(5) Handtighten two swing bolts (9) until a clicking noise occurs from each bolt.

(6) After clicking noise occurs, alternately handtighten each swing bolt (9) one-half turn until each bolt is tightened one full turn. Do not overtighten.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

h. Clean attach points on IMU alignment adapter (16), optical reference measurement unit (2), inertial measurement unit alignment box (IMU alignment box) (31) and target mirror assembly (4) using clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

- i. Visually inspect attach points to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- j. Make sure attach bolts (17) and (18) are clean and free of burrs and damaged threads.
- k. Lift optical reference measurement unit (2) by its carrying handle, hold against IMU alignment box (31) attach points.
- l. Engage and snug two upper attach bolts first, then the lower attach bolt.
- m. Hand tighten all three attach bolts (17) the same amount.
- n. Position target mirror assembly (4) against IMU alignment adapter (16) attach points.
- o. Engage and snug two upper attach bolts first, then the lower attach bolt.
- p. Hand tighten all three attach bolts (18) the same amount.
- q. Position optical target monitor (3) close to optical reference measurement unit (2) so video display (8) may be viewed while adjusting pitch and yaw micrometers (13) and (14).
- r. Connect cable (6) to optical target monitor (3) and optical reference measurement unit (2).

- s. Connect cable (7) to optical target monitor (3) and target mirror assembly (4).
- t. Connect power cable (5) to optical target monitor (3).
- u. Plug power cable (5) to electrical power source.
- v. Switch optical target monitor power switch (12) to ON.

NOTE

Do not adjust roll setting potentiometer (25).

- w. View video display (8) for crosshair position on target rings. If required, adjust pitch and yaw micrometers (13) and (14) by rotating pitch and yaw micrometer spindles (23) and (24) to get centering of crosshairs on target rings.

- x. Determine boresight reading:

- (1) Read and record plus-minus PITCH (20) and YAW (22) display indications to the nearest 0.1 milliradian.

- (2) Release swing-bolts (9) securing IMU mount alignment adapter (16) to electrical equipment mounting base (15).

- (3) Read and record plus-minus ROLL (21) display indications to the nearest 0.1 milliradian.

- (4) Reinstall swing-bolts (9) per steps g(3) thru g(6).

- y. Switch optical target monitor power switch (12) to OFF.

NOTE

There are two tolerances, an alignment verification tolerance and an initial alignment/realignment tolerance.

z. Determine if the mount pitch, roll, and yaw indications, recorded in step x, are within the applicable alignment tolerance per substeps below:

(1) Alignment verification tolerance (existing mount).

(a) Pitch: When the pitch is 0.0 ± 1.0 milliradian, the mount pitch is within tolerance.

(b) Roll: When the roll is 0.0 ± 1.0 milliradians, the mount roll is within tolerance.

(c) Yaw: When the yaw is 0.0 ± 1.0 milliradians, the mount yaw is within tolerance.

(2) Initial alignment/realignment tolerance (new or reinstalled mount).

(a) Pitch: When the pitch is 0.0 ± 0.5 milliradian, the mount pitch is within tolerance.

(b) Roll: When the roll is 0.0 ± 0.5 milliradian, the mount roll is within tolerance.

(c) Yaw: When the yaw is 0.0 ± 0.5 milliradian, the mount yaw is within tolerance.

aa. If the mount pitch, roll, and yaw are within the applicable tolerance, go to step ad. If the mount pitch and/or roll are not within tolerance, go to step ab. If only yaw is not within tolerance, go to step ac.

NOTE

When the mount pitch and/or roll are not within tolerance, realign the mount in PITCH, then ROLL, then YAW to get the best possible alignment. The mount is aligned by changing the shim thickness between the mount and shelf. See figure 2 for example of determining shim thickness. Two sets of shims will be required.

ab. When the mount (15) is out of pitch and/or roll alignment tolerance, realign the mount per substeps below:

NOTE

If indication is greater than listed, add indications as needed for required shim thickness.

(1) Using the conversion values in Table 1, convert the pitch indication, recorded in step x(1), to inch of shim adjustment and record.

(2) Using the conversion values in Table 2, convert the roll indication, recorded in step x(3), to inch of shim adjustment and record.

(3) Loosen, but do not remove, the mount (15) inboard pivot attach bolt (26).

(4) Remove the mount forward attach bolt (28) and remove shims (29) from between mount and shelf. Using a micrometer, measure and record existing shim (29) thickness at forward attach point.

(5) Remove the mount aft attach bolt (27) and remove shims (29) from between mount and shelf. Using a micrometer, measure and record existing shim (29) thickness at aft attach point.

(6) Determine shim (29) thickness required at forward attach bolt (28) per applicable substeps below:

(a) If step x(1) pitch indication is positive, subtract data recorded in substep ab(1) from existing shim thickness recorded in substep ab(4) and record.

(b) If step x(1) pitch indication is negative, add data recorded in substep ab(1) to existing shim thickness recorded in substep ab(4) and record.

(c) If step x(3) roll indication is positive, subtract data recorded in substep ab(2) from data recorded in substep ab(6)(a) or ab(6)(b), as applicable, and record as shim thickness to be installed at forward attach bolt.

(d) If step x(3) roll indication is negative, add data recorded in substep ab(2) to data recorded in substep ab(6)(a) or ab(6)(b), as applicable, and record as shim thickness to be installed at forward attach bolt.

(7) Determine shim (29) thickness required at aft attach bolt (27) per applicable substeps below:

(a) If step x(1) pitch indication is positive, add data recorded in substep ab(1) to existing shim thickness recorded in substep ab(5) and record.

(b) If step x(1) pitch indication is negative, subtract data recorded in substep ab(1) from existing shim thickness recorded in substep ab(5) and record.

(c) If step x(3) roll indication is positive, subtract data recorded in substep ab(2) from data recorded in substep ab(7)(a) or ab(7)(b), as applicable, and record as shim thickness to be installed at aft attach bolt.

(d) If step x(3) roll indication is negative, add data recorded in substep ab(2) to data recorded in substep ab(7)(a) or ab(7)(b), as applicable, and record as shim thickness to be installed at aft attach bolt.

(8) If shim thickness to be installed at either forward or aft attach bolt is less than 0.0 inch or more than 0.2005 inch, a depot engineering disposition is required.

(9) Using 950576 shims, and chart shown on figure, select combination of shims equal to shim thicknesses to be installed as determined in substep ab(6) and ab(7). For shim requisitioning (A1-F18AC-730-300, WP003 00).

(10) Prepare mount (15), shims (29), and shelf (30) for electrical bonding and sealing (A1-F18AC-LMM-000).

(11) Install shims (29), selected in substep ab(9), between mount (15) and shelf (30) at forward attach point. Install forward attach bolt (28) handtight.

(12) Install shims (29), selected in substep ab(9), between mount (15) and shelf (30) at aft attach point. Install aft attach bolt (27) handtight.

(13) Align the mount (15) yaw per substeps below:

(a) Switch optical target monitor power switch (12) to ON.

(b) While monitoring the optical target monitor (3) YAW display (22), shift the mount (15), forward or aft, until YAW display indicates 0.0 milliradians.

(c) Torque mount attach bolts (27 and 28) 130 to 170 inch-pounds and bolt (26) 80 to 90 inch-pounds.

(14) Determine boresight reading:

(a) Read and record plus-minus PITCH (20) and YAW (22) display indications to the nearest 0.1 milliradian.

(b) Release swing-bolts (9) securing IMU mount alignment adapter (16) to electrical equipment mounting base (15).

(c) Read and record plus-minus ROLL (21) display indications to the nearest 0.1 milliradian.

(d) Reinstall swing-bolts (9) per steps g(3) thru g(6).

(15) Switch optical target monitor power switch (12) to OFF.

(16) Determine if the mount (15) pitch, roll, and yaw are within initial alignment/realignment tolerance per substeps below:

(a) Pitch: When the PITCH display indication, recorded in substep ab(14)(a), is 0.0 ± 0.5 milliradian, the mount pitch is within tolerance.

(b) Yaw: When the YAW display indication, recorded in substep ab(14)(a), is 0.0 ± 0.5 milliradian, the mount yaw is within tolerance.

(c) Roll: When the ROLL display indication, recorded in substep ab(14)(c), is 0.0 ± 0.5 milliradian, the mount roll is within tolerance.

(17) If the mount pitch, yaw, and roll are within tolerance, as determined in substep ab(16), go to step ad. If the mount pitch or roll is not within tolerance, repeat step ab, except use display indications recorded in substep ab(14) for substeps ab(1) and ab(2) conversion. If only the mount yaw is not within tolerance, go to step ac.

ac. When only mount (15) yaw is out of alignment tolerance, realign the mount yaw per substeps below:

(1) Loosen, but do not remove, mount (15) three attach bolts (26, 27, and 28).

(2) Switch optical target monitor power switch (12) to ON.

(3) While monitoring the optical target monitor (3) YAW display (22), shift the mount (15), forward or aft, until the YAW display indicates 0.0 milliradian.

(4) Torque the mount attach bolts (27 and 28) 130 to 170 inch-pounds and bolt (26) 80 to 90 inch-pounds.

(5) If the YAW display is 0.0 ± 0.5 milliradian, the mount yaw is within tolerance. If not within tolerance, repeat step ac.

(6) Switch optical target monitor power switch (12) to OFF.

ad. Unplug power cable (5) from electrical power source.

ae. Disconnect power cable (5) from optical target monitor (3).

af. Disconnect cable (7) from optical target monitor (3) and target mirror assembly (4).

ag. Disconnect cable (6) from optical target monitor (3) and optical reference measurement unit (2).

ah. Remove target mirror assembly (4) from IMU alignment adapter (16) by removing three attach bolts (18).

ai. Remove optical reference measurement unit (2) from IMU alignment box (31) by removing three attach bolts (17).

aj. Remove IMU alignment adapter (16) from mount (15) per substeps below:

(1) Pull up on two swing bolt (9) knobs and turn counterclockwise until locking collar can be removed from IMU alignment adapter (16).

(2) Slide IMU alignment adapter (16) outboard off of two guide pins (19).

ak. Replace all boresighting equipment to proper storage areas.

al. Inspect door 13L area for foreign objects.

am. Install inertial navigation unit (A1-F18AC-730-300, WP004 00).

an. Close door 13L (A1-F18AC-LMM-010).

ao. If all boresighting is complete, remove and stow BRFA (1) (WP009 00).

ap. If all boresighting is complete, remove safety devices, as required (A1-F18AC-PCM-000).

Table 1. Conversion of Control/Display Unit PITCH Indication to Shim Thickness Adjustment

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
0.1	0.0004
0.2	0.0009

Table 1. Conversion of Control/Display Unit PITCH Indication to Shim Thickness Adjustment (Continued)

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
0.3	0.0013
0.4	0.0017
0.5	0.0021
0.6	0.0025
0.7	0.0030
0.8	0.0030
0.9	0.0040
1.0	0.0040
1.1	0.0045
1.2	0.0050
1.3	0.0055
1.4	0.0060
1.5	0.0060
1.6	0.0065
1.7	0.0070
1.8	0.0075
1.9	0.0080
2.0	0.0085
2.1	0.0090
2.2	0.0090
2.3	0.0100
2.4	0.0100
2.5	0.0105
2.6	0.0110
2.7	0.0115
2.8	0.0120

Table 1. Conversion of Control/Display Unit PITCH Indication to Shim Thickness Adjustment (Continued)

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
2.9	0.0120
3.0	0.0125
3.1	0.0130
3.2	0.0135
3.3	0.0140
3.4	0.0145
3.5	0.0150
3.6	0.0150
3.7	0.0155
3.8	0.0160
3.9	0.0165
4.0	0.0170
4.1	0.0175
4.2	0.0180
4.3	0.0180
4.4	0.0185
4.5	0.0190
4.6	0.0195
4.7	0.0200
4.8	0.0200
4.9	0.0205
5.0	0.0210
5.1	0.0215
5.2	0.0220
5.3	0.0225
5.4	0.0230

Table 1. Conversion of Control/Display Unit PITCH Indication to Shim Thickness Adjustment (Continued)

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
5.5	0.0235
5.6	0.0235
5.7	0.0240
5.8	0.0245
5.9	0.0250
6.0	0.0255
6.1	0.0260
6.2	0.0260
6.3	0.0265
6.4	0.0270
6.5	0.0275
6.6	0.0280
6.7	0.0285
6.8	0.0290
6.9	0.0290
7.0	0.0295
7.1	0.0300
7.2	0.0305
7.3	0.0310
7.4	0.0315
7.5	0.0320
7.6	0.0325
7.7	0.0325
7.8	0.0330
7.9	0.0335
8.0	0.0340

Table 1. Conversion of Control/Display Unit PITCH Indication to Shim Thickness Adjustment (Continued)

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
8.1	0.0345
8.2	0.0350
8.3	0.0350
8.4	0.0355
8.5	0.0360
8.6	0.0365
8.7	0.0370
8.8	0.0375
8.9	0.0380
9.0	0.0380
9.1	0.0385
9.2	0.0390
9.3	0.0395
9.4	0.0400
9.5	0.0405
9.6	0.0410
9.7	0.0410
9.8	0.0415
9.9	0.0420
10.0	0.0425

Table 2. Conversion of Control/Display Unit ROLL Indication to Shim Thickness Adjustment

ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
0.1	0.0008
0.2	0.0015
0.3	0.0023
0.4	0.0030
0.5	0.0038
0.6	0.0045
0.7	0.0053
0.8	0.0060
0.9	0.0068
1.0	0.0075
1.1	0.0080
1.2	0.0090
1.3	0.0095
1.4	0.0105
1.5	0.0110
1.6	0.0120
1.7	0.0125
1.8	0.0135
1.9	0.0140
2.0	0.0150
2.1	0.0155
2.2	0.0165
2.3	0.0170
2.4	0.0180
2.5	0.0185
2.6	0.0195

Table 2. Conversion of Control/Display Unit ROLL Indication to Shim Thickness Adjustment (Continued)

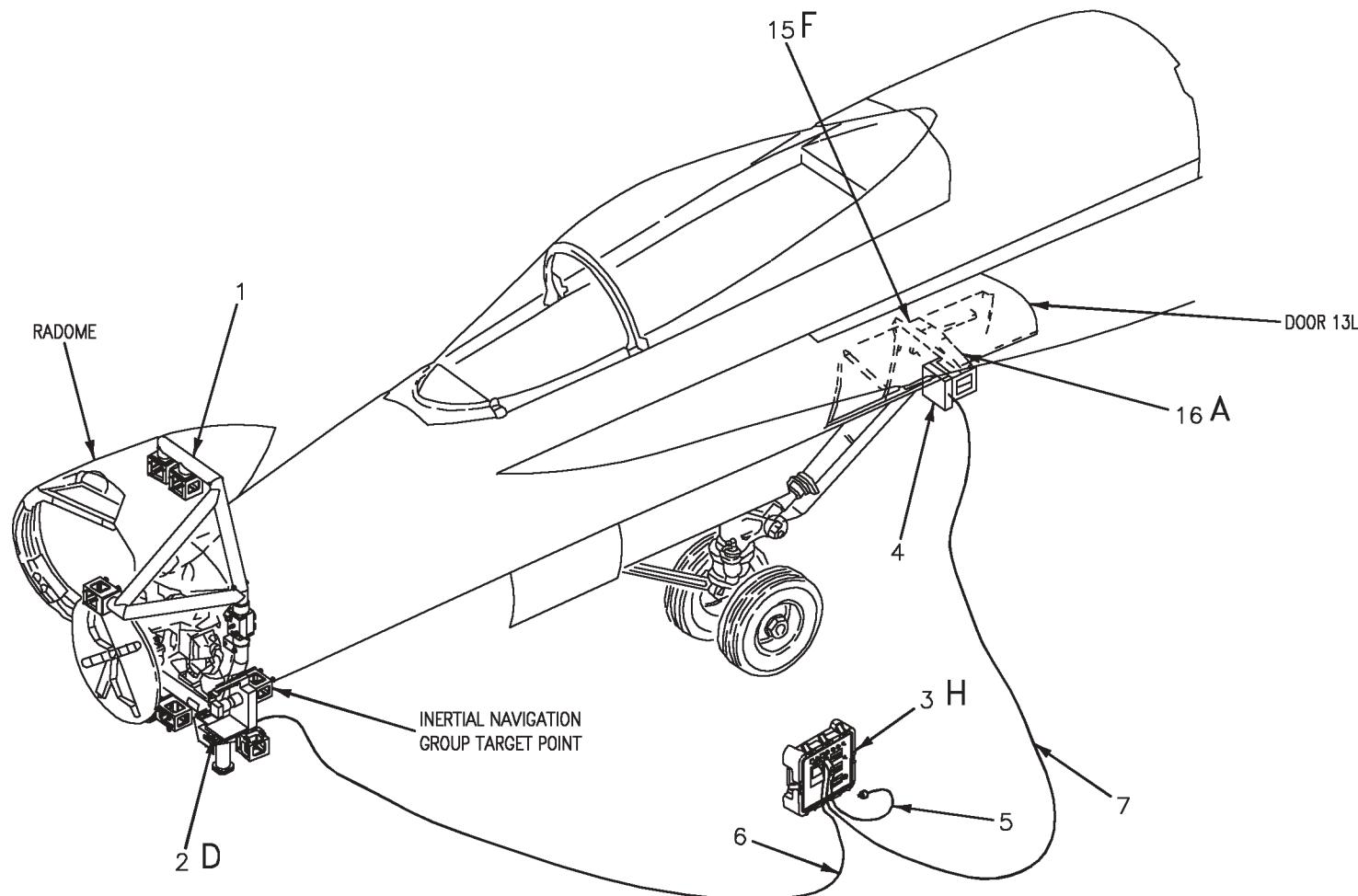
ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
2.7	0.0200
2.8	0.0205
2.9	0.0215
3.0	0.0225
3.1	0.0230
3.2	0.0240
3.3	0.0245
3.4	0.0255
3.5	0.0260
3.6	0.0270
3.7	0.0275
3.8	0.0285
3.9	0.0290
4.0	0.0300
4.1	0.0305
4.2	0.0315
4.3	0.0320
4.4	0.0330
4.5	0.0335
4.6	0.0345
4.7	0.0350
4.8	0.0360
4.9	0.0365
5.0	0.0375
5.1	0.0380
5.2	0.0390

Table 2. Conversion of Control/Display Unit ROLL Indication to Shim Thickness Adjustment (Continued)

ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
5.3	0.0395
5.4	0.0405
5.5	0.0410
5.6	0.0420
5.7	0.0425
5.8	0.0435
5.9	0.0440
6.0	0.0450
6.1	0.0455
6.2	0.0465
6.3	0.0470
6.4	0.0480
6.5	0.0485
6.6	0.0495
6.7	0.0500
6.8	0.0510
6.9	0.0515
7.0	0.0525
7.1	0.0530
7.2	0.0540
7.3	0.0550
7.4	0.0555
7.5	0.0560
7.6	0.0570
7.7	0.0580
7.8	0.0585

Table 2. Conversion of Control/Display Unit ROLL Indication to Shim Thickness Adjustment (Continued)

ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
7.9	0.0590
8.0	0.0600
8.1	0.0610
8.2	0.0615
8.3	0.0620
8.4	0.0630
8.5	0.0635
8.6	0.0645
8.7	0.0650
8.8	0.0660
8.9	0.0665
9.0	0.0675
9.1	0.0680
9.2	0.0690
9.3	0.0695
9.4	0.0705
9.5	0.0710
9.6	0.0720
9.7	0.0725
9.8	0.0735
9.9	0.0740
10.0	0.0750

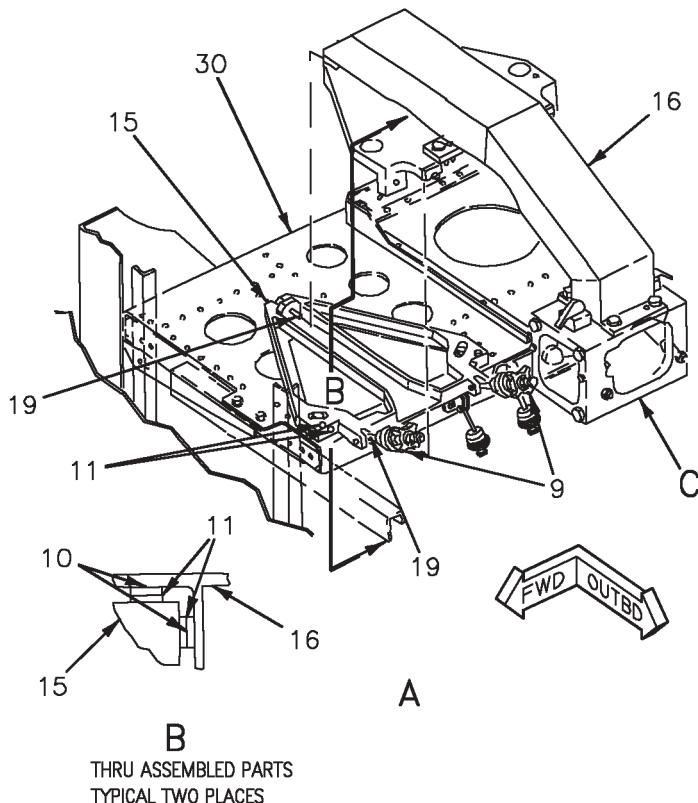


**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 1)**

Figure 1.

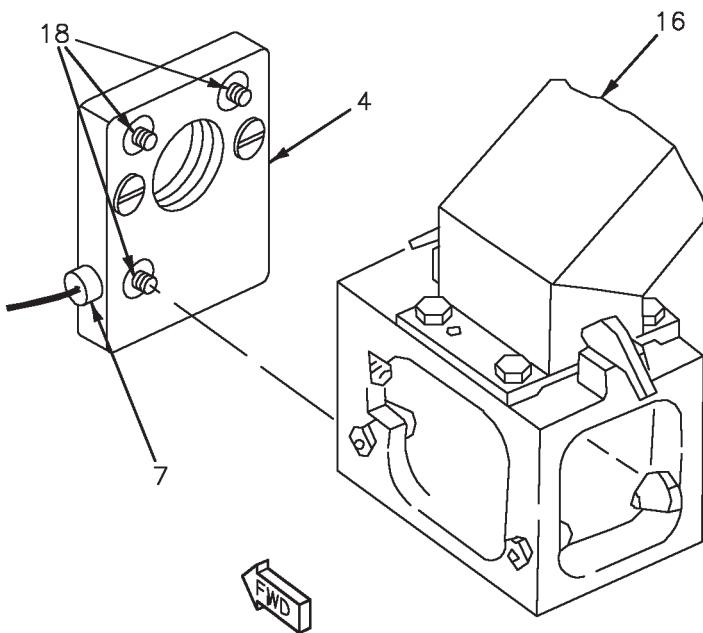
18AC-LMM-04-(19-1)11-SCAN

Figure 1.



18AC-LMM-04-(19-2)11-SCAN

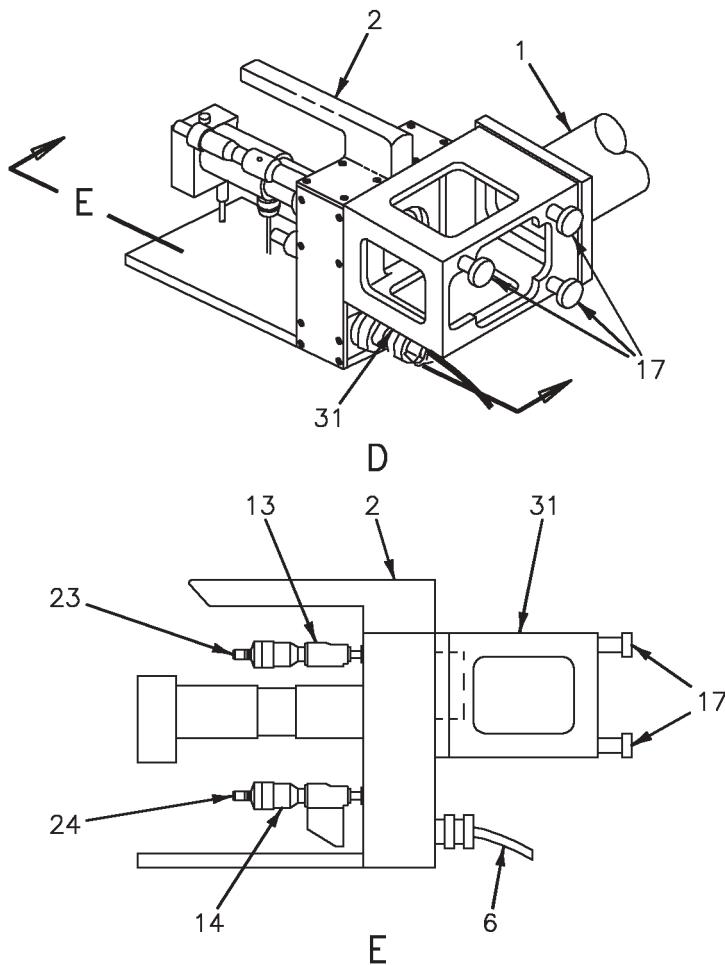
**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 2)**



C

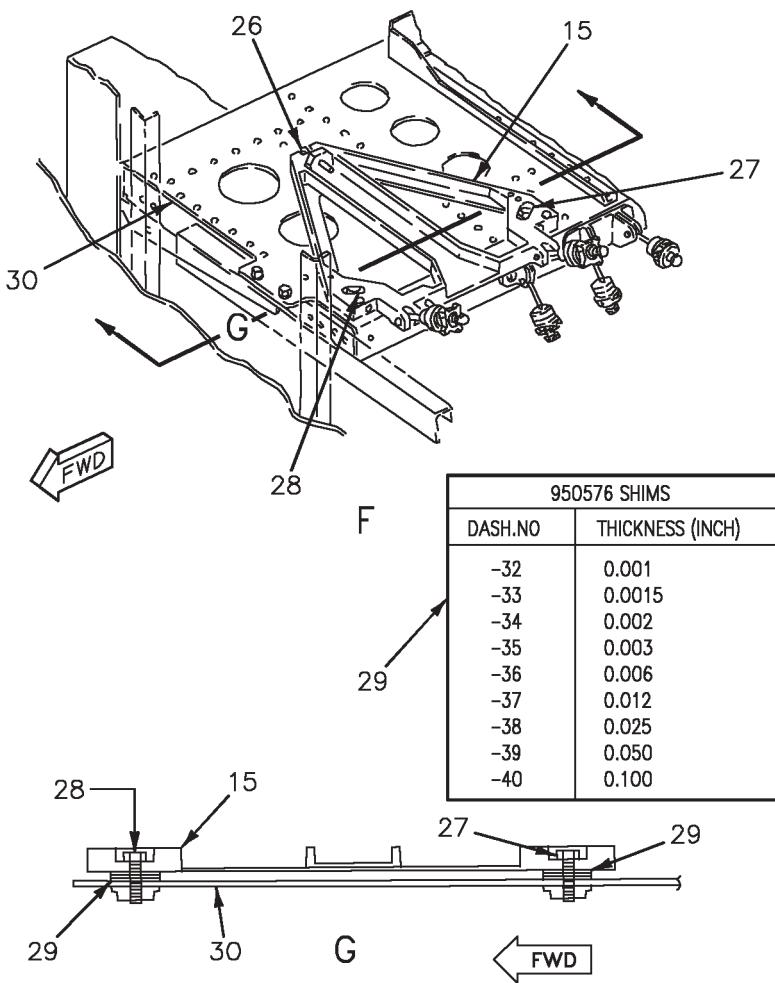
18AC-LMM-04-(19-3)11-SCAN

**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 3)**

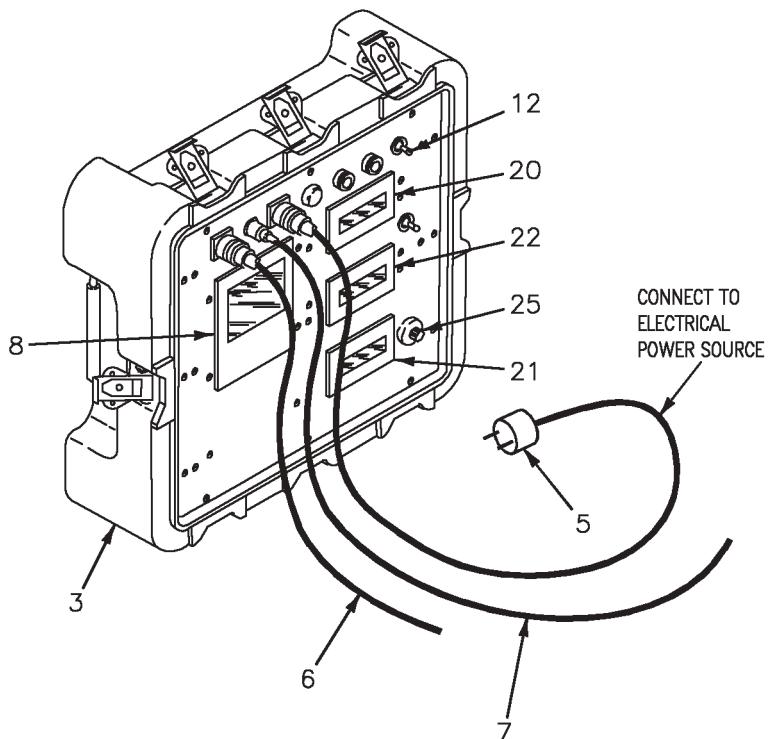


18AC-LMM-04-(19-4)11-SCAN

**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 4)**



**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 5)**

**H**

18AC-LMM-04-(19-6)11-SCAN

**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 6)**

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]◆	Boresight Reference Frame Assembly	74D111115
2 [2]◆	optical Reference Measurement Unit	537227
3 [2]◆	Optical Target Monitor	437228
4 [2]◆	Target Mirror Assembly	437232
5 [2]◆	Power Cable	437230-1
6 [2]◆	Cable	437230-2
7 [2]◆	Cable	437230-3
8	Video Display	—
9	Swing Bolt	—
10	Alignment Adapter Mounting Pad	—
11	Mount Pad	—
12	Power Switch	—
13	Pitch Micrometer	—
14	Yaw Micrometer	—
15	Electrical Equipment Mounting Base	—
16 [1]◆	IMU Alignment Adapter	74D111064
17	Attach Bolt	—
18	Attach Bolt	—
19	Guide Pin	—
20	Digital Display, Pitch	—
21	Digital Display, Roll	—
22	Digital Display, Yaw	—
23	Micrometer Spindle, Pitch	—
24	Micrometer Spindle, Yaw	—
25	Roll-Adjust Zero Potentiometer	—
26	Inboard Pivot Attach Bolt	—

**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 7)**

INDEX NO.	NOMENCLATURE	PART NUMBER
27	Aft Attach Bolt	NAS675V6
28	Forward Attach Bolt	NAS675V6
29	Shim	950576
30	Shelf	—
31	IMU Alignment Box	—

LEGEND

[1] Part of 74D110163 boresight alignment set.
[2] Part of 537226 optical alignment set.

**Figure 1. Inertial Navigation Unit Mounting Base
(Sheet 8)**

BORESIGHT READINGSPITCH = +1.9ROLL = +2.4**SHIM THICKNESS ADJUSTMENT**PITCH = 0.0080 (PER TABLE 1)ROLL = 0.0180 (PER TABLE 2)**EXISTING SHIM THICKNESS**FORWARD ATTACH POINT = 0.1560AFT ATTACH POINT = 0.1370**CALCULATION:****FORWARD ATTACH POINT**

0.1560 EXISTING SHIM THICKNESS

- 0.0080 "PITCH" SHIM THICKNESS ADJUSTMENT

0.1480

- 0.0180 "ROLL" SHIM THICKNESS ADJUSTMENT

0.1300 TOTAL SHIM THICKNESS REQUIRED**AFT ATTACH POINT**

0.1370 EXISTING SHIM THICKNESS

+ 0.0080 "PITCH" SHIM THICKNESS ADJUSTMENT

0.1450

- 0.0180 "ROLL" SHIM THICKNESS ADJUSTMENT

0.1270 TOTAL SHIM THICKNESS REQUIRED**Figure 2. Example of Determining Shim Thickness**

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****ELECTRICAL EQUIPMENT MOUNTING BASE****EMBEDDED GPS/INS (EGI) UNIT****USING 537226 OPTICAL ALIGNMENT SET**

Reference Material

Line Maintenance Procedures	A1-F18AC-LMM-000
Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Boresight Reference Frame Assembly	WP009 00
Alignment Set Verification Procedure	
Using 537226 Optical Alignment Set	WP010 02
Plane Captain Manual.....	A1-F18AC-PCM-000

Alphabetical Index**Subject****Page No.**

Aircraft Boresight Requirements	4
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Alphabetical Index (Continued)

Subject	Page No.
Aircraft Preparation.....	5
Alignment Procedure	5
Introduction.....	2
General Instructions.....	2
Safety Precautions.....	3

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for boresighting the Embedded GPS/INS (EGI) electrical equipment mounting base (mount) located in avionics equipment bay door 13L. This procedure is used to determine the mount pitch, roll, and yaw attitude in relation to the boresight reference frame assembly target point, and provides the step by step procedure for realigning the mount when out of tolerance.

3. There are two tolerances, an alignment verification tolerance and an initial alignment/realignment tolerance.

a. The alignment verification tolerance is used to determine if an in-service mount requires realignment.

b. The initial alignment/realignment tolerance is used when initially aligning a new mount and when realigning an in-service mount that has exceeded the alignment verification tolerance.

4. **GENERAL INSTRUCTIONS.** To make sure the mount is accurately boresighted, the instructions below shall be used:

- a. Boresighting should only be done ashore because of equipment sensitivity.
- b. Personnel must be familiar with the use and operation of the optical alignment set.
- c. Personnel must know the principles of boresighting.
- d. Boresighting should be done separately from other maintenance operations.
- e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
- f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.
- g. Attach bolts shall be clean and free of burrs and damaged threads.
- h. Visually inspect for loose or missing sealant around nuts on equipment.
- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

5. SAFETY PRECAUTIONS.

- a. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

6. AIRCRAFT BORESIGHT REQUIREMENTS.

7. Aircraft structural flexing affects boresight accuracy. To control the affect of this flexing and to be sure the mount boresight is accurate, make sure the aircraft is as listed below:

a. Forward fuselage:

- (1) Make sure all armament, avionics, electrical equipment, and/or ballast forward of the EGI mount is installed.
- (2) Make sure ammunition drum is empty.
- (3) Make sure windshield is closed.
- (4) Make sure door 3 is closed (A1-F18AC-LMM-010).

b. Cockpit(s): Make sure no personnel, tools and/or loose equipment are in cockpit.

c. Center and aft fuselage. No preferred configuration is required for these areas.

d. External stores.

(1) Pylons, weapon launcher and/or ejector racks may be installed on all stations and in any combination.

(2) Forward looking infrared system and laser detector-tracker-strike camera set are the only pods that may be installed.

(3) Make sure no weapons are installed.

8. AIRCRAFT PREPARATION.

- a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

9. ALIGNMENT PROCEDURE. See figure 1.**Support Equipment Required**

Part Number or Type Designation	Nomenclature
74D110163-1001	Boresight Align- ment Set
74D110256-1001	EGI Mount Alignment Adapter
537226	Optical Align- ment Set
—	Micrometer, 0 to 1 Inch
—	Torque Wrench, 0 to 200 Inch-Pounds

Materials Required

Specification or Part Number	Nomenclature
CCC-C-440 TYPE 1, CLASS 1	Cheesecloth
P-D-680, TYPE 2	Dry Cleaning Solvent
950576	Shims

- a. Verify alignment of optical alignment set (A1-F18AC-LMM-040, WP010 02).
- b. Set up and install boresight reference frame assembly (BRFA) (1) (A1-F18AC-LMM-040, WP009 00).
- c. Open door 13L (A1-F18AC-LMM-010).
- d. Make sure EGI Mount (mount) (2) is installed correctly and with a nominal thickness (0.1070 inch) of shims (3) between mount (2) and shelf (4), figure 1, detail A.
- e. Hand tighten attach bolts.
- f. Install 74D110256 EGI Mount Alignment Adapter (alignment adapter) (6) on mount (2), detail B:

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- (1) Clean attach points on alignment adapter (6) and mount (2) using clean cheesecloth moistened with solvent. Make sure two guide pins (7) are clean and free of burrs and threads of self-locking swing bolts (8) are clean.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

- (2) Slide alignment adapter (6) into the two mount guide pins (7).
- (3) Swing self-locking bolts (8) up on the alignment adapter (6).
- (4) Make sure alignment adapter (6) is firmly seated against the two mount guide pins (7).

NOTE

To prevent boresight errors, alternately handtighten swing bolts (8) an equal amount.

(5) Handtighten two swing bolts (8) until a clicking noise occurs from each bolt.

(6) After clicking noise occurs, alternately handtighten each swing bolt (8) one-half turn until each bolt is snugly tightened. Do not overtighten.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

g. Clean attach points on alignment box located on alignment adapter (6), optical reference measurement unit (9), EGI unit alignment box (alignment box) (10) and target mirror assembly (11) using clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

- h. Visually inspect attach points to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- i. Make sure attach bolts (12) and (13) are clean and free of burrs and damaged threads.
- j. Lift optical reference measurement unit (9) by its carrying handle, hold against alignment box (10) attach points, detail C.
- k. Engage and snug two upper attach bolts first, then the lower attach bolt.
- l. Hand tighten all three attach bolts (12) the same amount, detail C.
- m. Position target mirror assembly (11) against alignment adapter (6) attach points, detail E.
- n. Engage and snug two upper attach bolts first, then the lower attach bolt.
- o. Hand tighten all three attach bolts (13) the same amount, detail E.
- p. Position optical target monitor (14) close to optical reference measurement unit (9) so video display (15) may be viewed while adjusting pitch and yaw micrometers (16) and (17).

- q. Connect cable (18) to optical target monitor (14) and optical reference measurement unit (9), details C and F.
- r. Connect cable (19) to optical target monitor (14) and target mirror assembly (11), details E and F.
- s. Connect power cable (20) to optical target monitor (14), detail F.
- t. Plug power cable (20) to electrical power source.
- u. Switch optical target monitor power switch (21) to ON, detail F.

NOTE

Do not adjust roll setting potentiometer (22).

- v. Adjust EGI mount about the YAW axis until crosshairs are centered on the optical target monitor's vertical axis.
- w. Torque inboard forward mount attach bolt to 40 inch-pounds, then alternate to other bolts. Increase torque in increments of 20 inch-pounds until 80-90 inch-pounds is applied to all bolts.

NOTE

It may require adjusting EGI mount about the YAW axis again before all bolts are torqued to 80-90 inch-pounds.

- x. View video display (15) for crosshair position on target rings. If required, adjust pitch and yaw micrometers (16) and (17) by rotating pitch and yaw micrometer spindles (23) and (24) to get centering of crosshairs on target rings, details D and F.

y. Determine boresight reading:

- (1) Read and record plus-minus PITCH (25) and YAW (27) display indications to the nearest 0.1 milliradian, detail F.
- (2) Release swing-bolts (8) securing alignment adapter (6) to mount (2), detail E.
- (3) Read and record plus-minus ROLL (26) display indication to the nearest 0.1 milliradian, detail F.
- (4) Reinstall swing bolts (8).

z. Switch optical target monitor power switch (21) to OFF, detail F.

aa. Determine if the mount pitch, roll, and yaw indications are within the applicable alignment tolerance per substeps below:

- (1) Pitch: When the pitch is 0.0 ± 0.5 milliradian, the mount pitch is within tolerance.
- (2) Roll: When the roll is 0.0 ± 0.5 milliradian, the mount roll is within tolerance.
- (3) Yaw: When the yaw is 0.0 ± 0.5 milliradian, the mount yaw is within tolerance.

ab. If the mount pitch, roll, and yaw are within the applicable tolerance, go to step ae. If the mount pitch and/or roll are not within tolerance, go to step ac. If only yaw is not within tolerance, go to step ad.

NOTE

When the mount pitch and/or roll are not within tolerance, realign the mount in PITCH, then ROLL, then YAW to get the best possible alignment. The mount is aligned by changing the shim thickness between the mount and shelf. See figure 2 for example of determining shim thickness. Two sets of shims will be required.

ac. When the mount (2) is out of pitch and/or roll alignment tolerance, realign the mount per substeps below:

NOTE

If indication is greater than listed, add indications as needed for required shim thickness.

(1) Using the conversion values in Table 1, convert the pitch indication, recorded in step y, to inch of shim adjustment and record.

(2) Using the conversion values in Table 2, convert the roll indication, recorded in step y, to inch of shim adjustment and record.

(3) Remove the mount and remove shims (3) from between mount and shelf. Using a micrometer, measure and record existing shim thickness at each attach point.

(4) Determine shim thickness required at inboard forward attach bolt per applicable substeps below:

- (a) If step y pitch indication is positive, subtract data recorded in substep ac(1) from existing shim thickness recorded in substep ac(3) and record.
- (b) If step y pitch indication is negative, add data recorded in substep ac(1) to existing shim thickness recorded in substep ac(3) and record.
- (c) If step y roll indication is positive, add data recorded in substep ac(2) to data recorded in substep ac(4)(a) or ac(4)(b), as applicable, and record as shim thickness to be installed at inboard forward attach bolt.
- (d) If step y roll indication is negative, subtract data recorded in substep ac(2) from data recorded in substep ac(4)(a) or ac(4)(b), as applicable, and record as shim thickness to be installed at inboard forward attach bolt.

(5) Determine shim thickness required at inboard aft attach bolt per applicable substeps below:

- (a) If step y pitch indication is positive, add data recorded in substep ac(1) to existing shim thickness recorded in substep ac(3) and record.
- (b) If step y pitch indication is negative, subtract data recorded in substep ac(1) from existing shim thickness recorded in substep ac(3) and record.
- (c) If step y roll indication is positive, add data recorded in substep ac(2) to data recorded in substep ac(5)(a) or ac(5)(b), as applicable, and record as shim thickness to be installed at inboard aft attach bolt.

(d) If step y roll indication is negative, subtract data recorded in substep ac(2) from data recorded in substep ac(5)(a) or ac(5)(b), as applicable, and record as shim thickness to be installed at inboard aft attach bolt.

(6) If shim thickness to be installed at either the inboard forward or aft attach bolt locations is less than 0.0 inch or more than 0.2005 inch, a depot engineering disposition is required.

(7) Using 950576 shims on table 3, select combination of shims equal to shim thicknesses to be installed as determined in substep ac(4) and ac(5).

(8) Prepare mount (2), shims (3), and shelf (4) for electrical bonding and sealing (A1-F18AC-LMM-000).

(9) Install shims (3), selected in substep ac(7), between mount (2) and shelf (4) at inboard forward attach point. Install inboard forward attach bolt (5) handtight.

(10) Install shims (3), selected in substep ac(7), between mount (2) and shelf (4) at inboard aft attach point. Install inboard aft attach bolt (5) handtight.

(11) Align the mount (2) yaw per substeps below:

(a) Switch optical target monitor power switch (21) to ON, detail F.

(b) Adjust EGI mount about the YAW axis until crosshairs are centered on the optical target monitor's vertical axis.

- (c) While monitoring the optical target monitor (14) YAW display (27), shift the mount (2), forward or aft, until YAW display indicates 0.0 milliradians.
- (d) Torque inboard forward mount attach bolt to 40 inch-pounds, then alternate to other bolts. Increase torque in increments of 20 inch-pounds until 80-90 inch-pounds is applied to all bolts.

NOTE

It may require adjusting EGI mount about the YAW again before all bolts are torqued to 80-90 inch-pounds.

- (12) Determine boresight reading:

- (a) Read and record plus-minus PITCH (25) and YAW (27) display indications to the nearest 0.1 milliradian.
- (b) Release swing-bolts (8) securing alignment adapter (6) to mount (2).
- (c) Read and record plus-minus ROLL (26) display indications to the nearest 0.1 milliradian.
- (d) Reinstall swing-bolts (8).
- (e) Switch optical target monitor power switch (21) to OFF.

- (13) Determine if the mount (2) pitch, roll, and yaw are within tolerance per substeps below:

- (a) Pitch: When the PITCH display indication is 0.0 ± 0.5 milliradian, the mount pitch is within tolerance.

(b) Yaw: When the YAW display indication is 0.0 ± 0.5 milliradian, the mount yaw is within tolerance.

(c) Roll: When the ROLL display indication is 0.0 ± 0.5 milliradian, the mount roll is within tolerance.

(14) If the mount pitch, yaw, and roll are within tolerance , go to step ae. If the mount pitch or roll is not within tolerance, repeat this procedure from step y. If only the mount yaw is not within tolerance, go to step ad.

ad. When only mount (2) yaw is out of alignment tolerance, realign the mount yaw per substeps below:

(1) Loosen, but do not remove, mount (2) three attach bolts (5), detail E.

(2) Switch optical target monitor power switch (21) to ON, detail F.

(3) Adjust EGI mount about the YAW axis until crosshairs are centered on the optical target monitor's vertical axis.

(4) While monitoring the optical target monitor (14) YAW display (27), shift the mount (2), forward or aft, until YAW display indicates 0.0 milliradians.

(5) Torque inboard forward mount attach bolt to 40 inch-pounds, then alternate to other bolts. Increase torque in increments of 20 inch-pounds until 80-90 inch-pounds is applied to all bolts.

NOTE

It may require adjusting EGI mount about the YAW again before all bolts are torqued to 80-90 inch-pounds.

- (6) If the YAW display is 0.0 ± 0.5 milliradian, the mount yaw is within tolerance. If not within tolerance, repeat step ad.
 - (7) Switch optical target monitor power switch (21) to OFF.
 - ae. Unplug power cable (20) from electrical power source.
 - af. Disconnect power cable (19) from optical target monitor (14), detail F.
 - ag. Disconnect cable (19) from optical target monitor (14) and target mirror assembly (11), details E and F.
 - ah. Disconnect cable (18) from optical target monitor (14) and optical reference measurement unit (9), details C and F.
 - ai. Remove target mirror assembly (11) from alignment adapter (6) by removing three attach bolts (13), detail E.
 - aj. Remove optical reference measurement unit (9) from alignment box (10) by removing three attach bolts (12), detail C.
 - ak. Remove alignment adapter (6) from mount (2) per detail B and substeps below:
 - (1) Pull up on two swing bolt (8) knobs and turn counterclockwise until locking collar can be removed from alignment adapter (6).

(2) Slide alignment adapter (6) outboard off of two guide pins (7).

al. Replace all boresighting equipment to correct storage areas.

am. Inspect door 13L area for foreign objects.

an. Close door 13L (A1-F18AC-LMM-010).

ao. If all boresighting is complete, remove and stow BRFA (1) (A1-F18AC-LMM-040, WP009 00).

ap. If all boresighting is complete, remove safety devices, as required (A1-F18AC-PCM-000).

Table 1. Conversion of PITCH Indication to Shim Thickness Adjustment

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
0.1	0.0003
0.2	0.0005
0.3	0.0008
0.4	0.0010
0.5	0.0013
0.6	0.0015
0.7	0.0018
0.8	0.0020
0.9	0.0023
1.0	0.0025
1.1	0.0028

Table 1. Conversion of PITCH Indication to Shim Thickness Adjustment (Continued)

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
1.2	0.0030
1.3	0.0033
1.4	0.0035
1.5	0.0038
1.6	0.0040
1.7	0.0043
1.8	0.0045
1.9	0.0048
2.0	0.0050
2.1	0.0053
2.2	0.0055
2.3	0.0058
2.4	0.0060
2.5	0.0063
2.6	0.0065
2.7	0.0068
2.8	0.0070
2.9	0.0073
3.0	0.0075
3.1	0.0078
3.2	0.0080
3.3	0.0083
3.4	0.0085
3.5	0.0088
3.6	0.0090
3.7	0.0093

Table 1. Conversion of PITCH Indication to Shim Thickness Adjustment (Continued)

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
3.8	0.0095
3.9	0.0098
4.0	0.0100
4.1	0.0103
4.2	0.0105
4.3	0.0108
4.4	0.0110
4.5	0.0113
4.6	0.0115
4.7	0.0118
4.8	0.0120
4.9	0.0123
5.0	0.0125
5.1	0.0128
5.2	0.0130
5.3	0.0133
5.4	0.0135
5.5	0.0138
5.6	0.0140
5.7	0.0143
5.8	0.0145
5.9	0.0148
6.0	0.0150
6.1	0.0153
6.2	0.0155
6.3	0.0158

Table 1. Conversion of PITCH Indication to Shim Thickness Adjustment (Continued)

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
6.4	0.0160
6.5	0.0163
6.6	0.0165
6.7	0.0168
6.8	0.0170
6.9	0.0173
7.0	0.0175
7.1	0.0178
7.2	0.0180
7.3	0.0183
7.4	0.0185
7.5	0.0188
7.6	0.0190
7.7	0.0193
7.8	0.0195
7.9	0.0198
8.0	0.0200
8.1	0.0203
8.2	0.0205
8.3	0.0208
8.4	0.0210
8.5	0.0213
8.6	0.0215
8.7	0.0218
8.8	0.0220
8.9	0.0223

Table 1. Conversion of PITCH Indication to Shim Thickness Adjustment (Continued)

PITCH Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
9.0	0.0225
9.1	0.0228
9.2	0.0230
9.3	0.0233
9.4	0.0235
9.5	0.0238
9.6	0.0240
9.7	0.0243
9.8	0.0245
9.9	0.0248
10.0	0.0250

Table 2. Conversion of ROLL Indication to Shim Thickness Adjustment

ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
0.1	0.0009
0.2	0.0017
0.3	0.0026
0.4	0.0034
0.5	0.0043
0.6	0.0051
0.7	0.0060
0.8	0.0068

Table 2. Conversion of ROLL Indication to Shim Thickness Adjustment (Continued)

ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
0.9	0.0077
1.0	0.0085
1.1	0.0094
1.2	0.0102
1.3	0.0111
1.4	0.0119
1.5	0.0128
1.6	0.0136
1.7	0.0145
1.8	0.0153
1.9	0.0162
2.0	0.0170
2.1	0.0179
2.2	0.0187
2.3	0.0196
2.4	0.0204
2.5	0.0213
2.6	0.0221
2.7	0.0230
2.8	0.0238
2.9	0.0247
3.0	0.0255
3.1	0.0264
3.2	0.0272
3.3	0.0281
3.4	0.0289

Table 2. Conversion of ROLL Indication to Shim Thickness Adjustment (Continued)

ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
3.5	0.0298
3.6	0.0306
3.7	0.0315
3.8	0.0323
3.9	0.0332
4.0	0.0340
4.1	0.0349
4.2	0.0357
4.3	0.0366
4.4	0.0374
4.5	0.0383
4.6	0.0391
4.7	0.0400
4.8	0.0408
4.9	0.0417
5.0	0.0425
5.1	0.0434
5.2	0.0442
5.3	0.0451
5.4	0.0459
5.5	0.0468
5.6	0.0476
5.7	0.0485
5.8	0.0493
5.9	0.0502
6.0	0.0510

Table 2. Conversion of ROLL Indication to Shim Thickness Adjustment (Continued)

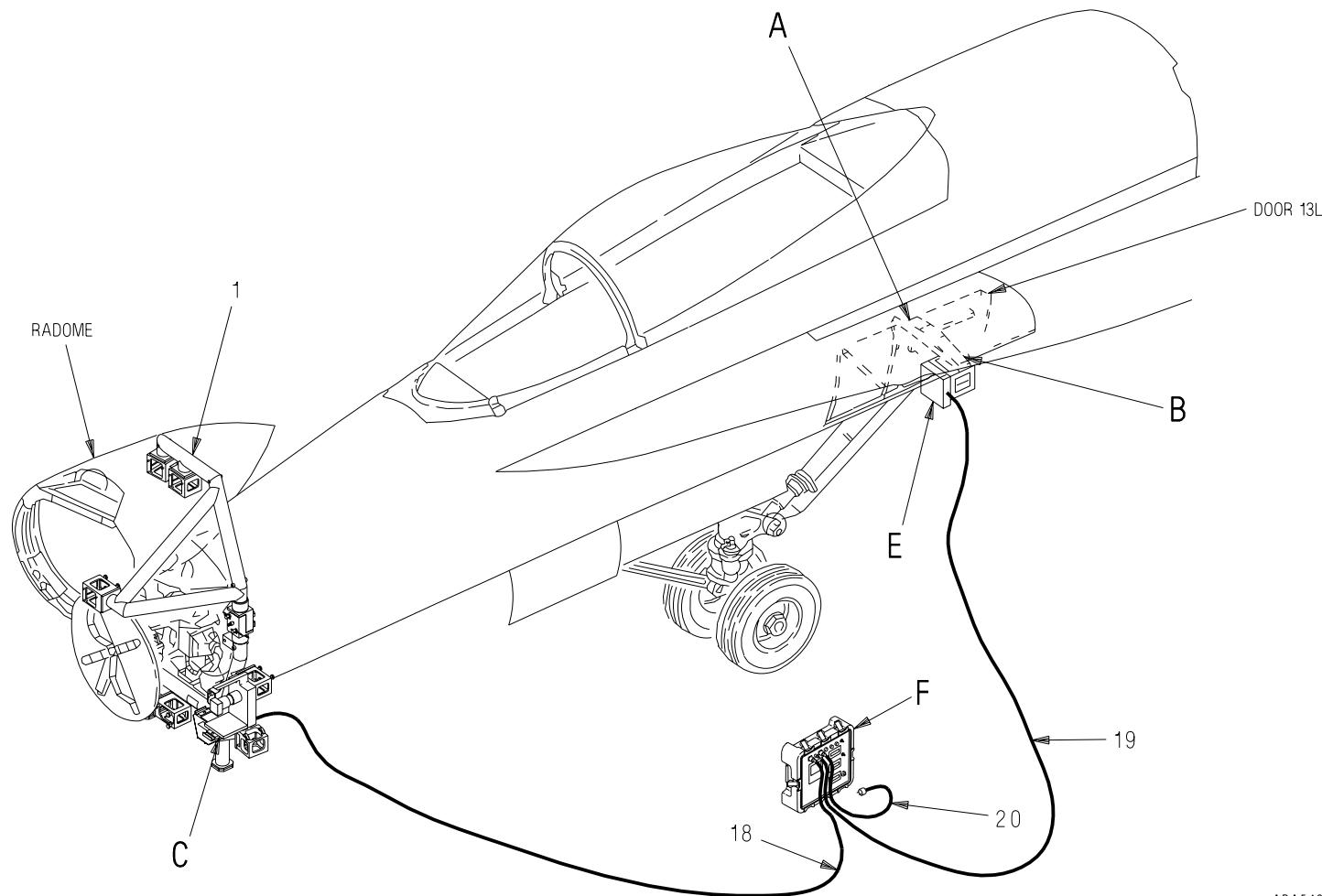
ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
6.1	0.0519
6.2	0.0527
6.3	0.0536
6.4	0.0544
6.5	0.0553
6.6	0.0561
6.7	0.0570
6.8	0.0578
6.9	0.0587
7.0	0.0595
7.1	0.0604
7.2	0.0612
7.3	0.0621
7.4	0.0629
7.5	0.0638
7.6	0.0646
7.7	0.0655
7.8	0.0663
7.9	0.0672
8.0	0.0680
8.1	0.0689
8.2	0.0697
8.3	0.0706
8.4	0.0714
8.5	0.0723
8.6	0.0731

Table 2. Conversion of ROLL Indication to Shim Thickness Adjustment (Continued)

ROLL Indication Milliradians	Inch of Shim Adjustment Required at Attach Points
8.7	0.0740
8.8	0.0748
8.9	0.0757
9.0	0.0765
9.1	0.0774
9.2	0.0782
9.3	0.0791
9.4	0.0799
9.5	0.0808
9.6	0.0816
9.7	0.0825
9.8	0.0833
9.9	0.0842
10.0	0.0850

Table 3. 950576 Shims

Dash Number	Thickness (Inches)
-32	0.001
-33	0.0015
-34	0.002
-35	0.003
-36	0.006
-37	0.012
-38	0.025
-39	0.050
-40	0.100

**Figure 1. EGI Mount Alignment (Sheet 1)****Figure 1.**

ADA549-24-1-016

Figure 1.

A1-F18AC-LMM-040

Change 4

003 03

Page 29

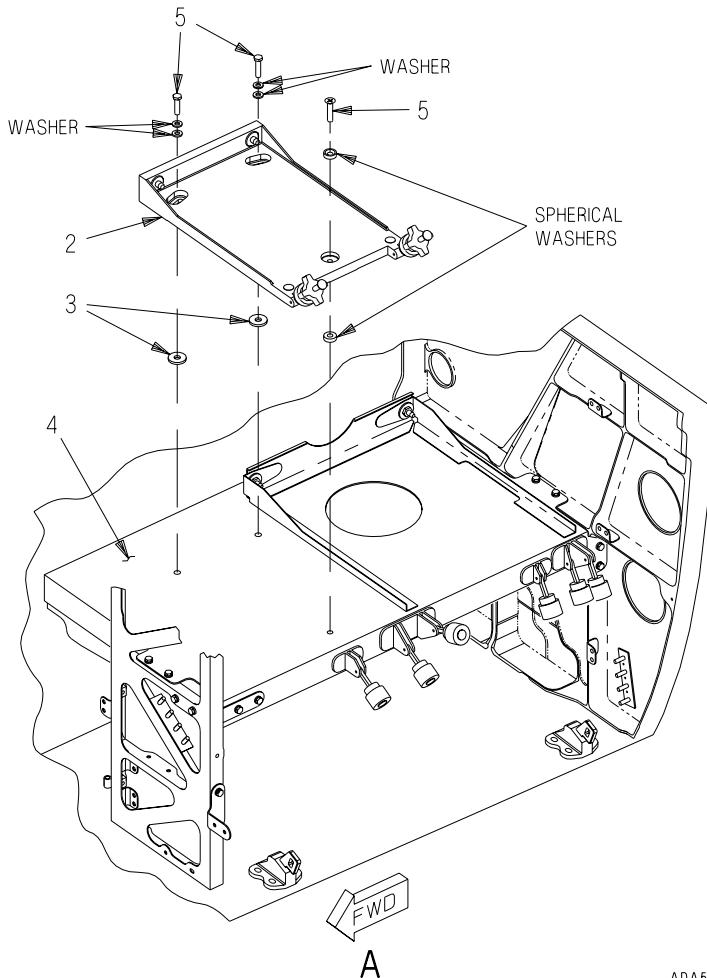


Figure 1. EGI Mount Alignment (Sheet 2)

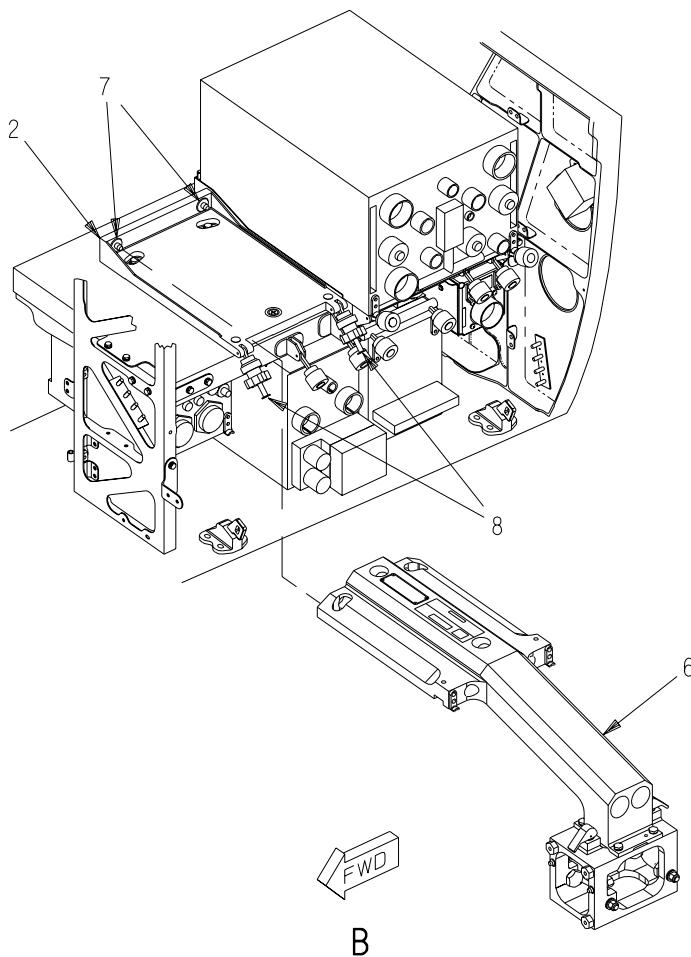
ADA549-24-2-016

A1-F18AC-LMM-040

Change 4

003 03

Page 30



B

ADA549-24-3-016

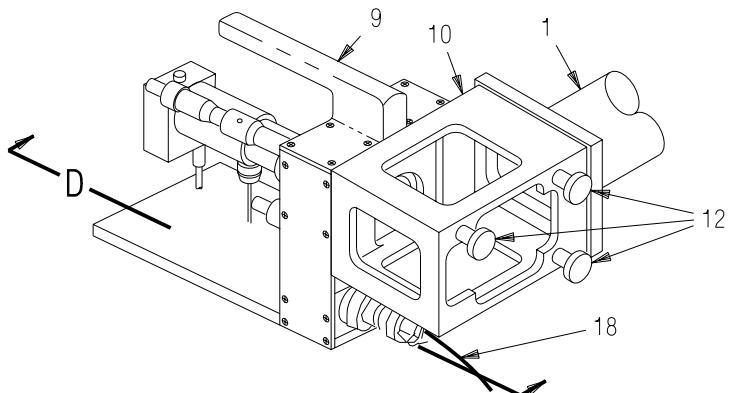
Figure 1. EGI Mount Alignment (Sheet 3)

A1-F18AC-LMM-040

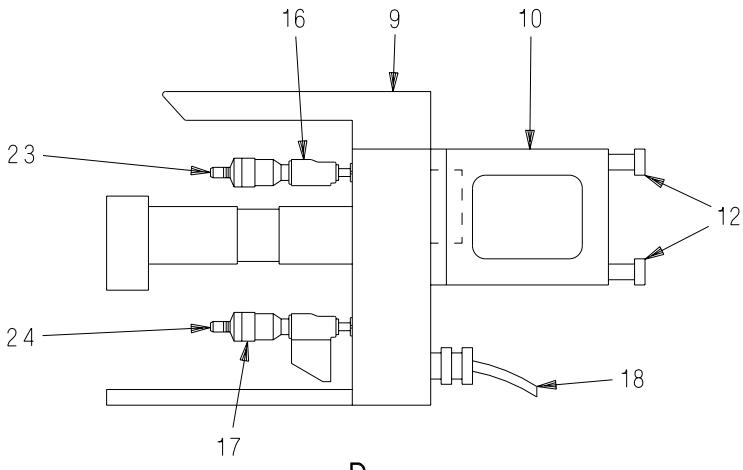
Change 4

003 03

Page 31



C



D

ADA549-24-4-016

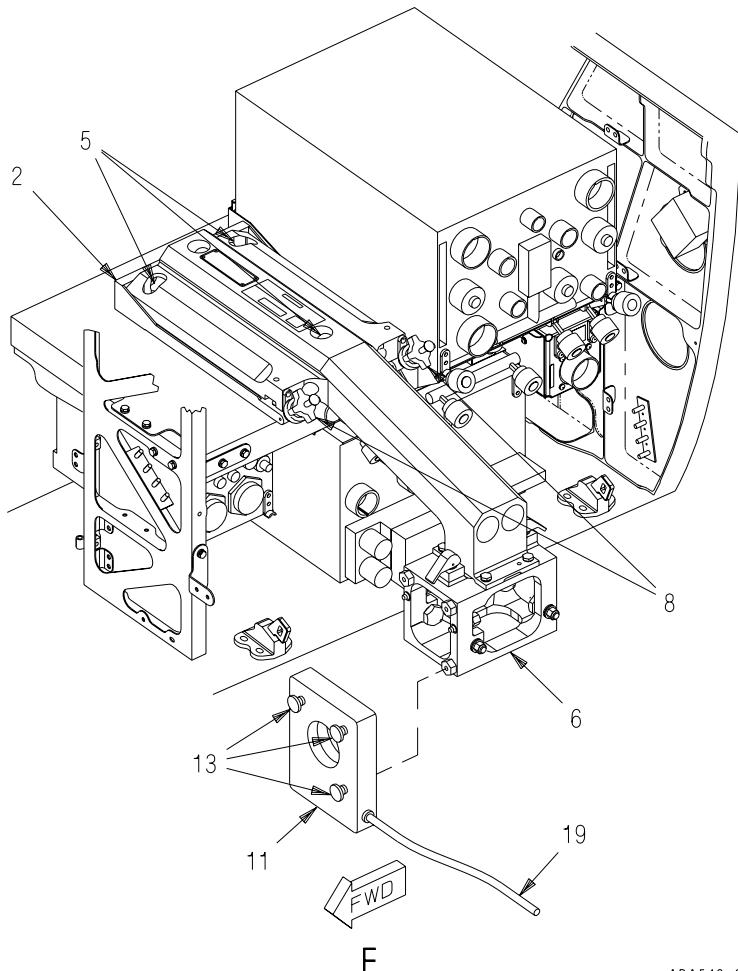
Figure 1. EGI Mount Alignment (Sheet 4)

A1-F18AC-LMM-040

Change 4

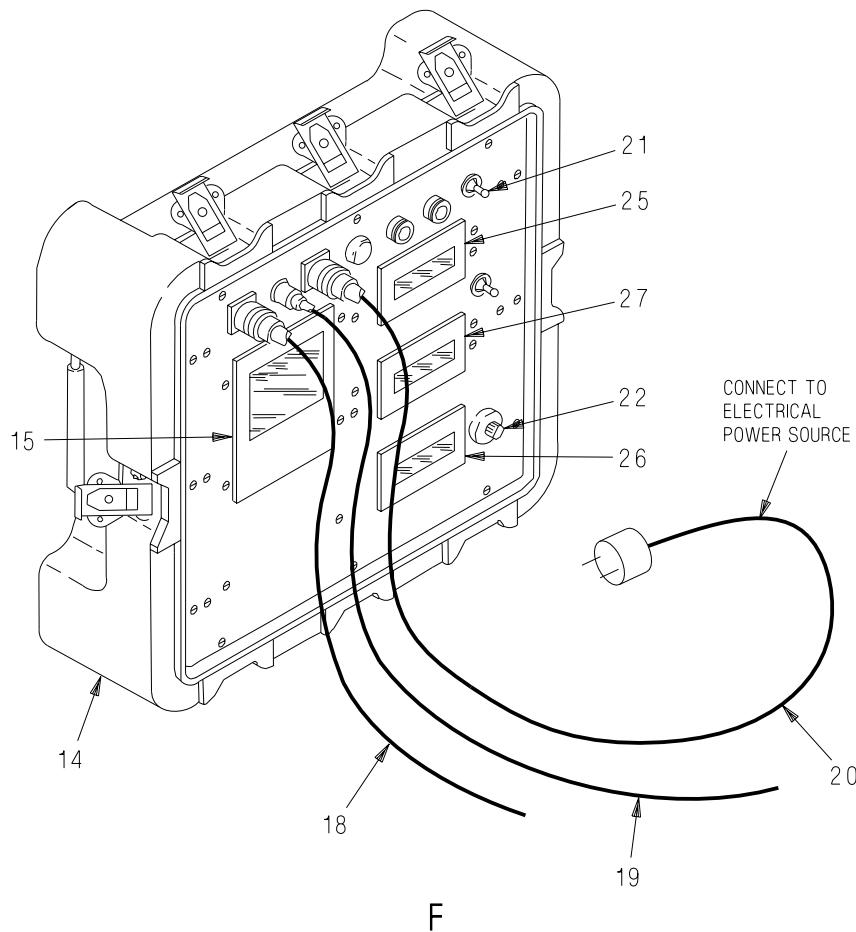
003 03

Page 32



ADA549-24-5-016

Figure 1. EGI Mount Alignment (Sheet 5)

**Figure 1. EGI Mount Alignment (Sheet 6)**

INDEX NO	NOMENCLATURE	PART NUMBER
1 [1]	Boresight Reference Frame Assembly	74D111115
2	Mount	—
3	Shim	950576
4	Shelf	—
5	Attach Bolt	—
6 [1]	Alignment Adapter	74D110256
7	Guide Pin	—
8	Swing Bolt	—
9 [2]	Optical Reference Measurement Unit	537227
10	Alignment Box	—
11 [2]	Target Mirror Assembly	437232
12	Attach Bolt	—
13	Attach Bolt	—
14 [2]	Optical Target Monitor	437228
15	Video Display	—
16	Pitch Micrometer	—
17	Yaw Micrometer	—
18 [2]	Cable	437230-2
19 [2]	Cable	437230-3
20 [2]	Power Cable	437230-1
21	Power Switch	—
22	Roll-Adjust Zero Potentiometer	—
23	Micrometer Spindle, Pitch	—
24	Micrometer Spindle, Yaw	—
25	Digital Display, Pitch	—
26	Digital Display, Roll	—
27	Digital Display, Yaw	—

Figure 1. EGI Mount Alignment (Sheet 7)

INDEX NO	NOMENCLATURE	PART NUMBER
LEGEND		
1 Part of 74D110163 boresight alignment set.		
2 Part of 537226 optical alignment set.		

Figure 1. EGI Mount Alignment (Sheet 8)

BORESIGHT READINGS

PITCH = +1.9
ROLL = +2.4

SHIM THICKNESS ADJUSTMENT

PITCH = 0.0048 (PER TABLE 1)
ROLL = 0.0204 (PER TABLE 2)

EXISTING SHIM THICKNESS

FORWARD ATTACH POINT = 0.1560
AFT ATTACH POINT = 0.1370

CALCULATION:**FORWARD ATTACH POINT**

0.1560 EXISTING SHIM THICKNESS
- 0.0048 "PITCH" SHIM THICKNESS ADJUSTMENT
0.1512
+ 0.0204 "ROLL" SHIM THICKNESS ADJUSTMENT
0.1716 TOTAL SHIM THICKNESS REQUIRED

AFT ATTACH POINT

0.1370 EXISTING SHIM THICKNESS
+ 0.0048 "PITCH" SHIM THICKNESS ADJUSTMENT
0.1418
+ 0.0204 "ROLL" SHIM THICKNESS ADJUSTMENT
0.1622 TOTAL SHIM THICKNESS REQUIRED

Figure 2. Example of Determining Shim Thickness

A1-F18AC-LMM-040

Change 1 - 1 April 1994

004 00

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ORGANIZATIONAL MAINTENANCE

LINE MAINTENANCE BORESIGHTING DATA

HEAD-UP DISPLAY UNIT

AND

ASSEMBLY OF HUD ELECTRICAL EQUIPMENT MOUNTING BASE

This WP supersedes WP004 00, dated 1 June 1993.

Title	WP Number
Head-Up Display Unit and Assembly of HUD Electrical Equipment Mounting Base	
Using 74D110021 Triaxial Alignment Set	004 01
Using 537226 Optical Alignment Set	004 02

**ORGANIZATIONAL MAINTENANCE
LINE MAINTENANCE BORESIGHTING DATA
HEAD-UP DISPLAY UNIT
AND
ASSEMBLY OF HUD ELECTRICAL EQUIPMENT MOUNTING BASE
USING 74D110021 TRIAXIAL ALIGNMENT SET**

Reference Material

Line Maintenance Procedures	A1-F18AC-LMM-000
Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Seat, Canopy, Survival Equipment and Boarding Ladder.....	A1-F18AC-120-300
Windshield - Removal and Installation	WP117 00
Seat, Canopy, Survival Equipment and Boarding Ladder.....	A1-F18AE-120-300
Windshield - Removal and Installation	WP080 00
Communication, TACAN, ADF, Electronic Altimeter and IFF Systems.....	A1-F18AC-600-300
Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002)	WP003 00

Reference Material (Continued)

Weapon Control Systems	A1-F18AC-740-200
Electrical Boresight Compensation	
System Test.....	WP040 00
Weapon Control Systems	A1-F18AE-740-200
Electrical Boresight Compensation	
System Test.....	WP181 00
Multipurpose Display Group	A1-F18AC-745-300
Head-Up Display Unit AN/AVQ-28.....	WP003 00
Multipurpose Display Group	A1-F18AG-745-300
Head-Up Display Unit AN/AVQ-32.....	WP003 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	4
Aircraft Preparation.....	5
HUD Mount Alignment Verification/ Initial Alignment Procedure	6
HUD Unit Alignment Verification Procedure	21
Introduction.....	2A
General Instructions.....	3
Safety Precautions.....	4

Record of Applicable Technical Directives

None

1. INTRODUCTION.

2. This work package provides organizational level maintenance procedures for boresighting the HEAD UP DISPLAY (HUD) unit and the HUD mounting base (HUD mount). The HUD MOUNT

ALIGNMENT VERIFICATION is used if HUD misalignment is suspected or to realign a mount that has been removed from the aircraft. When doing alignment verification, the windshield is installed and only the PITCH and YAW will be adjusted. ROLL cannot be accurately measured with the windshield installed. The HUD MOUNT INITIAL ALIGNMENT is used to align a new mount after installation. When doing the initial alignment, the windshield must be removed to get an accurate ROLL adjustment. HUD UNIT ALIGNMENT VERIFICATION PROCEDURE should be done after values have been input into electrical boresight compensation unit (EBCU), and aircraft power cycled. If HUD unit is not within allowable tolerances, the HUD unit must be replaced.

3. GENERAL INSTRUCTIONS. To make sure mount is accurately boresighted, the instructions below shall be used:

- a. Due to equipment sensitivity, boresighting should only be done ashore.
- b. Personnel must be familiar with the use and operation of the triaxial alignment set.
- c. Personnel must know the principles of boresighting.
- d. Boresighting should be done separately from other maintenance operations.
- e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
- f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.

- g. Attach bolts shall be clean and free of burrs and damaged threads.
- h. Visually inspect for loose or missing sealant around nuts on equipment.
- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.
- j. Visually inspect HUD adapter assembly, 74D111079, to make sure filter is installed and is not cracked or damaged.

4. SAFETY PRECAUTIONS.**WARNING**

Laser radiation, do not look into laser beams or eye injury could occur. However, when doing HUD unit alignment verification, make sure filter is installed in the HUD adapter assembly and is not cracked or damaged. The filter will prevent eye injury from laser radiation.

- a. Be sure aircraft ground safety-ejection control handle/aircraft canopy jettison pins are installed (A1-F18AC-PCM-000).
- b. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

5. AIRCRAFT BORESIGHT REQUIREMENTS.

- 6. Aircraft structural flexing affects boresight accuracy. To control the effect of this flexing and to be sure the boresight is accurate, make sure the aircraft is as listed below:

- a. Make sure all armament, avionics, electrical equipment and ballast is installed.
- b. Make sure ammunition drum is empty.
- c. Make sure windshield is closed unless an initial alignment procedure is being done.
- d. Make sure no loose tools and/or equipment are in cockpit.
- e. Make sure door 3 is closed (A1-F18AC-LMM-010).
- f. No other specific requirements are necessary.

7. AIRCRAFT PREPARATION.

- a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).
- b. Clean windshield (A1-F18AC-PCM-000).

8. HUD MOUNT ALIGNMENT VERIFICATION/INITIAL ALIGNMENT/REALIGNMENT PROCEDURE. See figure 1.**Support Equipment Required**

Part Number or Type Designation	Nomenclature
74D110163-1001 (74D110022-1001)	Boresight Alignment Set (HUD Mount Alignment Adapter)
74D110021-1003 (74D110021-1001) —	Triaxial Alignment Set
	Torque Wrench, 0 to 150 Inch-Pounds

Materials Required

Specification or Part Number	Nomenclature
CCC-C-440 TYPE 1, CLASS 1	Cheesecloth
P-D-680, TYPE 2	Dry Cleaning Solvent

- a. Verify alignment of triaxial alignment set (WP010 01).
- b. Set up and install boresight reference frame assembly (BRFA) (WP009 00).

c. Remove Head-Up Display Unit (A1-F18AC-745-300, WP003 00 or A1-F18AG-745-300, WP003 00).

d. If an initial alignment is being done, new mount was installed, remove windshield (A1-F18AC-120-300, WP117 00 or A1-F18AE-120-300, WP080 00).

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

e. Clean attach bushing mating surfaces on 74D111159 beam splitter assembly (2) and 74D111059 head up display mount adapter assembly (HUD mount adapter) (3) by wiping with clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

f. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.

g. Make sure attach bolts are clean and free of burrs and damaged threads.

- h. Lift beam splitter (2) by the box frame near the top and hold against HUD mount adapter (3) attach bushings.
- i. Engage and snug two upper attach bolts first, then the lower attach bolt.
- j. Hand tighten all three attach bolts (4) the same amount.
- k. Install HUD mount adapter (3) on the assembly of HUD electrical equipment mounting base (mount) (5) per substeps below:

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- (1) Clean mating surfaces of HUD mount adapter (3) and mount using cheesecloth moistened with solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

- (2) Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.

- (3) Make sure two alignment pins (6) are clean and free of burrs.

CAUTION

To prevent damage to windshield, be careful when installing HUD mount adapter.

(4) Slide HUD mount adapter (3) forward onto two alignment pins (6) and over two studs (7).

(5) Install HUD mount adapter (3) two attach bolts (8) in the aft two studs (7). Initially torque the two bolts to 45 ± 5 inch-pounds. Continue to torque the two bolts sequentially in 10 inch-pound increments to 75 ± 5 inch-pounds.

1. Install 74D111180 laser (9) in HUD mount adapter (3) per substeps below:

(1) Wipe all oil and fingerprints from steel tube using clean cheesecloth.

(2) Open two laser clamps (10).

(3) Slide laser (9) forward into HUD mount adapter (3) until line on laser plate is aligned with aft edge of HUD mount adapter.

(4) Rotate laser (9) to align up line on laser plate with up mark on HUD mount adapter (3).

(5) Close two laser clamps (10).

NOTE

Misalignment of lines can degrade boresight accuracy.

(6) Verify that line on laser (9) is still aligned with mark on HUD mount adapter (3).

NOTE

Failure to hook chain may degrade boresight accuracy.

(7) Hook chain (16) to HUD mount adapter (3).

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

m. Clean mating surfaces on 74D111167 triaxial detector unit (TDU)(11) and boresight reference frame assembly (BRFA)(1) using cheesecloth moistened with solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

- n. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- o. Make sure attach bolts are clean and free of burrs and damaged threads.
- p. Lift TDU (11) by its carrying handle, hold against BRFA (1) at the HUD target point.
- q. Engage and snug two upper attach bolts first, then the lower attach bolt.
- r. Hand tighten all three attach bolts (12) the same amount.

NOTE

Failure to hook chain (15) may degrade boresight accuracy.

- s. Hook chain (15) to BRFA (1) to support cable.
- t. If an alignment verification is being done, existing HUD mount has been removed and reinstalled in aircraft , do step u. If an initial alignment is being done, existing HUD mount has been replaced with new HUD mount, do step v.
- u. When doing an alignment verification, do substeps below:

WARNING

Laser radiation, do not look into laser beams, or eye injury could occur.

NOTE

The main laser light will illuminate when control/display unit (13) is turned on. When laser (9) energy is not sensed by the TDU after approximately 15 seconds, it will inhibit the laser, causing the main laser light to go off.

- (1) Press control/display unit switch (19) to on position.

NOTE

The mount pitch, roll, and yaw indications are displayed on the control/display unit. However, only the pitch and yaw indications are used when doing an alignment verification. Ignore roll indication. Because of equipment sensitivity, five indications should be taken, then use the average of these indications for alignment correction.

Normal equipment operation will allow the displayed ROLL reading to fluctuate as much as ± 0.50 milliradians about a median value. Operator judgement should be used to determine this median roll value.

(2) Read plus-minus PITCH (20) and YAW (21) display indications. Ignore ROLL (22) indication. Record indications to nearest 0.5 milliradian.

(3) Push control/display unit (13) switch (19) to off position.

NOTE

Electrical boresight compensation assembly has a range from -7.5 to +7.5 milliradians.

(4) If pitch and yaw indications are between -7.5 and +7.5 milliradians, the electrical boresight compensation assembly (23) shall be used to correct the misalignment. Go to next step. Indications below -7.5 or above +7.5 milliradians require an depot engineering disposition.

(5) Open door 13R (A1-F18AC-LMM-010).

(6) Remove aft Receiver-Transmitter RT-1250/ARC-182(V)
(76A-F002) (A1-F18AC-600-300, WP003 00).

NOTE

Electrical boresight compensation assembly has a plus-minus thumbwheel switch and a milliradian thumbwheel switch for each of the HUD pitch, roll, and yaw indications.

(7) Read and record electrical boresight compensation assembly (23) HUD plus-minus PITCH and YAW thumbwheel switch (24) settings.

(8) If the HUD plus-minus PITCH and YAW thumbwheel switch settings are not the same as new boresight indications, go to next step. If they are the same, go to substep (15).

(9) Remove guard (25) from electrical boresight compensation assembly (23) by removing attach bolts (26).

NOTE

When inputting data into the electrical boresight compensation assembly, ignore existing recorded data. Adjust the thumbwheel switches, until the applicable plus or minus sign and milliradian numbers are displayed in the switch windows. When inputting data into the HUD thumbwheel switches, do not change the other system thumbwheel switch settings as it will cause the affected system to have the wrong boresight compensation data.

(10) Input new boresight settings into electrical boresight compensation assembly (23) HUD plus-minus PITCH and YAW thumbwheel switches (24). Do not change HUD ROLL switch.

(11) Record new thumbwheel switch (24) settings on Miscellaneous History Card OPNAV 4790/25A, part of the Aircraft Log Book.

NOTE

Setting GUN-MC thumbwheel switch is a factory adjustment and should not be changed.

(12) Verify GUN-MC thumbwheel switch on electrical boresight compensation assembly (23) is set on +2.0 for 161353 THRU 161987 or +2.5 for 162394 AND UP.

(13) Do electrical boresight compensation system test (A1-F18AC-740-200, WP040 00 or A1-F18AE-740-200, WP181 00).

(14) Install guard (25) with attach bolts (26).

(15) Install aft Receiver-Transmitter RT-1250/ARC-182(V)
(76A-F002) (A1-F18AC-600-300, WP003 00).

(16) Inspect door 13R for foreign objects.

(17) Close door 13R (A1-F18AC-LMM-010).

v. When doing an initial alignment, do substeps below:

WARNING

Laser radiation, do not look into laser beams or eye injury could occur.

NOTE

The main laser light will illuminate when control/display unit is turned on. When laser energy is not sensed by the TDU after approximately 15 seconds, it will inhibit the laser, causing the main laser light to go off.

(1) Press control/display unit switch (19) to ON position.

NOTE

The mount pitch, roll, and yaw indications are displayed on the control/display unit. The PITCH, ROLL, and YAW displays are graduated in 0.01 milliradian increments. Because of equipment sensitivity, five indications should be taken, then use the average of these indications for alignment correction.

Normal equipment operation will allow the displayed ROLL reading to fluctuate as much as ± 0.50 milliradians about a median value. Operator judgement should be used to determine this median roll value.

(2) Read plus-minus PITCH (20), YAW (21), and ROLL (22) display indications. Record indications to the nearest 0.5 milliradian.

(3) Push control/display unit (13) switch (19) to off position.

NOTE

Electrical boresight compensation assembly has a range from -7.5 to $+7.5$ milliradians.

(4) If pitch, roll, and yaw indications are between -7.5 and $+7.5$ milliradians, the electrical boresight compensation assembly (23) shall be used to correct the misalignment. Go to next step. Indications below -7.5 or above $+7.5$ milliradians require an depot engineering disposition.

(5) Open door 13R (A1-F18AC-LMM-010).

(6) Remove aft Receiver-Transmitter RT-1250/ARC-182(V)
(76A-F002) (A1-F18AC-600-300, WP003 00).

NOTE

Electrical boresight compensation assembly has a plus-minus thumbwheel switch and a milliradian thumbwheel switch for each of the HUD pitch, roll, and yaw indications.

(7) Read and record electrical boresight compensation assembly (23) HUD plus-minus PITCH, ROLL, and YAW thumbwheel switch (24) settings.

(8) If the HUD plus-minus PITCH, ROLL, and YAW thumbwheel switch settings are not the same as new boresight indications, go to next step. If they are the same, go to substep (15).

(9) Remove guard (25) from electrical boresight compensation assembly (23) by removing attach bolts (26).

NOTE

When inputting data into the electrical boresight compensation assembly, ignore existing recorded data. Adjust the thumbwheel switches, until the applicable plus or minus sign and milliradian numbers are displayed in the switch windows. When inputting data into the HUD thumbwheel switches, do not change the other system thumbwheel switch settings as it will cause the affected system to have the wrong boresight compensation data.

(10) Input new boresight settings into the electrical boresight compensation assembly (23) HUD plus-minus PITCH, ROLL, and YAW thumbwheel switches (24).

(11) Record new thumbwheel switch (24) settings on Miscellaneous History Card OPNAV 4790/25A, part of the Aircraft Log Book.

NOTE

Setting GUN-MC thumbwheel switch is a factory adjustment and should not be changed.

(12) Verify GUN-MC thumbwheel switch on electrical boresight compensation assembly (23) is set on +2.0 for 161353 THRU 161987 or +2.5 for 162394 AND UP.

(13) Do electrical boresight compensation system test (A1-F18AC-740-200, WP040 00 or A1-F18AE-740-200, WP181 00).

(14) Install guard (25) with attach bolts (26).

(15) Install aft Receiver-Transmitter RT-1250/ARC-182(V)
(76A-F002) (A1-F18AC-600-300, WP003 00).

(16) Inspect door 13R for foreign objects.

(17) Close door 13R (A1-F18AC-LMM-010).

w. Remove TDU (11) from BRFA (1) by removing three attach bolts (12) and install on check fixture.

x. Remove laser (9) from HUD mount adapter (3) per substeps below:

(1) Unhook chain (16) from HUD mount adapter (3).

(2) Open two laser clamps (10).

(3) Slide laser (9) aft out of HUD mount adapter (3) and install on check fixture.

(4) Close two laser clamps (10).

y. Remove HUD mount adapter (3), with beam splitter assembly (2) attached, from mount (5) per substeps below:

(1) Remove two attach bolts (8).



To prevent damage to windshield, be careful when removing HUD mount adapter.

(2) Slide HUD mount adapter (3) aft off of alignment pins (6) and studs (7).

- z. Remove beam splitter assembly (2) from HUD mount adapter (3) by removing three attach bolts (4) and install on check fixture.
- aa. Reinstall windshield, if required (A1-F18AC-120-300, WP117 00 or A1-F18AE-120-300, WP080 00).
- ab. Install Head-Up Display Unit (A1-F18AC-745-300, WP003 00 or A1-F18AG-745-300, WP003 00).
- ac. Do HUD UNIT ALIGNMENT VERIFICATION, this WP.

9. HUD UNIT ALIGNMENT VERIFICATION PROCEDURE.

See figure 2.

NOTE

If HUD misalignment is suspected, HUD MOUNT ALIGNMENT VERIFICATION procedure should always be done before doing HUD UNIT ALIGNMENT VERIFICATION procedure.

Support Equipment Required

Part Number or Type Designation	Nomenclature
--	---------------------

74D110163-1001 (74D110024-1001)	Boresight Alignment Set (HUD Alignment Adapter)
74D110021-1003 (74D110021-1001)	Triaxial Alignment Set

Materials Required

**Specification
or Part Number****Nomenclature**

CCC-C-440 TYPE 1,
CLASS 1
P-D-680,
TYPE 2

Cheesecloth
Dry Cleaning
Solvent

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- a. Clean mating surfaces on 74D111079 HUD adapter assembly (HUD adapter)(1) and BRFA (3) using cheesecloth moistened with solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

- b. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.

- c. Make sure attach bolts are clean and free of burrs and damaged threads.
- d. Lift HUD adapter (1) by box frame near the top and hold against BRFA (3) at HUD target point.
- e. Engage and snug two upper attach bolts first, then the lower attach bolt.
- f. Hand tighten all three attach bolts (12) the same amount.
- g. Install 74D111180 laser (4) in HUD adapter (1) per substeps below:
 - (1) Wipe all oil and fingerprints from steel tube using clean cheesecloth.
 - (2) Open two laser clamps (10).
 - (3) Slide laser (4) aft into HUD adapter until line on laser plate is aligned with forward edge of HUD adapter.
 - (4) Rotate laser (4) with line on laser plate in up position.
 - (5) Close two laser clamps (10).

NOTE

Misalignment of lines can degrade boresight accuracy.

- (6) Verify that line on laser (4) is still aligned with forward edge of HUD adapter.

NOTE

Failure to hook chain may degrade boresight accuracy.

(7) Hook chain (9) to BRFA (3).

h. Apply electrical power (A1-F18AC-LMM-000).

i. On GND PWR control panel assembly (13), set 1 switch to A ON and 2 switch to B ON.

j. On right digital display indicator (RDDI) (15), set OFF/NIGHT/AUTO/DAY switch to AUTO.

k. Turn on HUD unit (2) by setting HUD SYM - BRT control to center position. Allow 2 minutes warm up.

l. Set HUD unit (2) DAY/AUTO/NIGHT switch to either DAY or NIGHT, as required, for ambient light conditions.

m. Adjust HUD unit (2) HUD SYM - BRT control for best display on combiner assembly (14).

n. Adjust RDDI (15) BRT and CONT controls for best display on RDDI.

o. On RDDI (15), press MENU pushbutton switch.

p. On RDDI (15), press BIT pushbutton switch.

q. On RDDI (15), press DISP/EPI/UFC pushbutton switch. Combiner assembly (14) has test pattern with boresight box displayed.

NOTE

When doing this procedure, the HUD adapter filters laser beam to prevent eye injury.

The main laser light will illuminate when control/display unit (5) is turned on. When laser energy is not sensed by the TDU after approximately 15 seconds, it will inhibit the laser, causing the main laser light to go off.

- r. Press control/display unit switch (11) to ON position.
- s. Determine if HUD symbology is aligned with BRFA (3) HUD target point per substeps below:
 - (1) Assume pilots normal position in cockpit.

NOTE

Laser will remain on for only 15 seconds. Reactivate by pushing control/display unit switch. Laser beam will appear on combiner assembly as a very small dot. Use care not to overlook laser beam.

- (2) Looking through combiner assembly (14), determine if laser beam is within the boresight box displayed on combiner assembly.
- (3) If laser beam is within boresight box, the HUD is aligned within alignment tolerance, complete this procedure. If laser beam is not within boresight box the HUD unit should be replaced.

t. Push control/display unit (5) switch (11) to off position.

- u. On RDDI (15), press STOP pushbutton switch.
- v. On HUD unit (2), turn HUD SYM - BRT control to OFF.
- w. On RDDI (15), set OFF/NIGHT/AUTO/DAY switch to OFF.
- x. On GND PWR control panel assembly (13), set 1 and 2 switches to AUTO.
- y. Remove electrical power (A1-F18AC-LMM-000).
- z. Remove laser (4) from HUD adapter (1) per substeps below:
 - (1) Unhook chain (9) from BRFA (3).
 - (2) Open two laser clamps (10).
 - (3) Slide laser (4) forward out of HUD adapter and install on check fixture.
 - (4) Close two laser clamps (10).
- aa. Remove HUD adapter (1) from BRFA (3) by removing three attach bolts (12).
- ab. Inspect cockpit for foreign objects.
- ac. If all boresighting is completed, remove and stow BRFA (WP009 00).
- ad. If all boresighting is completed, remove safety devices, as required (A1-F18AC-PCM-000).

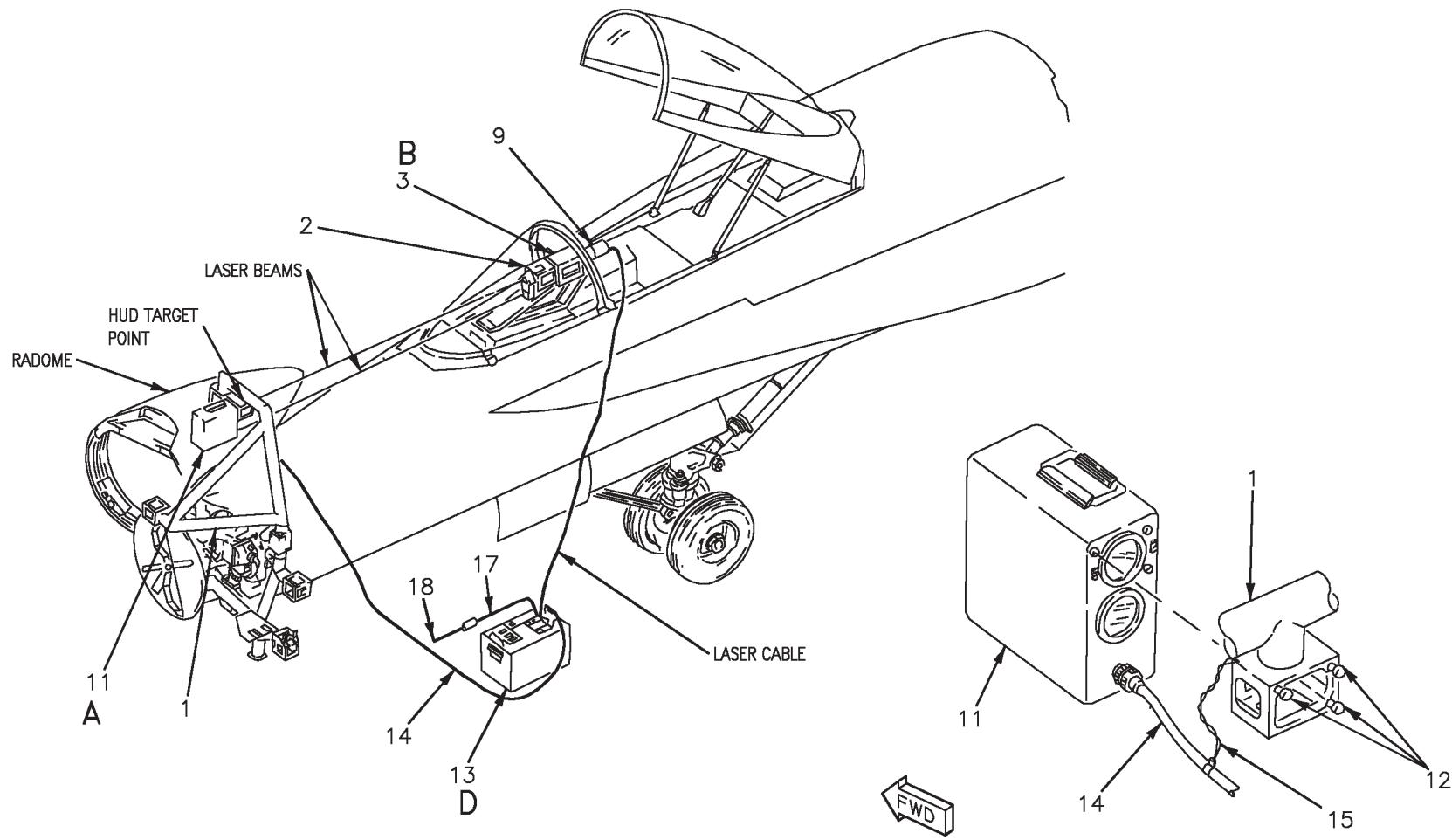
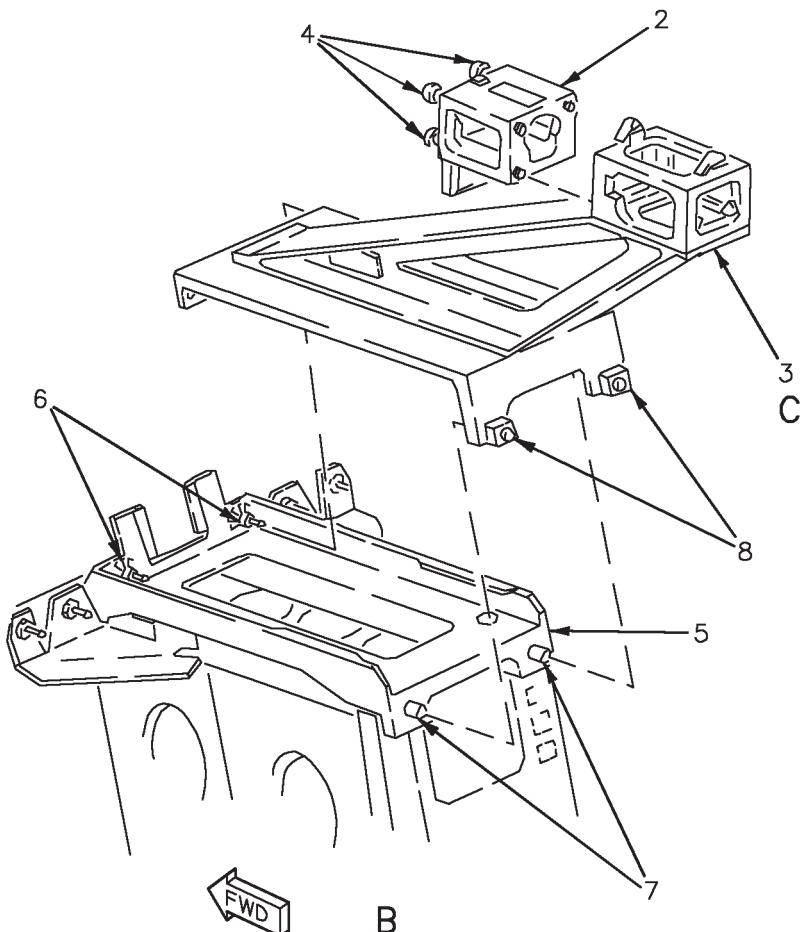


Figure 1. Head-Up Display Unit Mounting Base
(Sheet 1)

Figure 1.

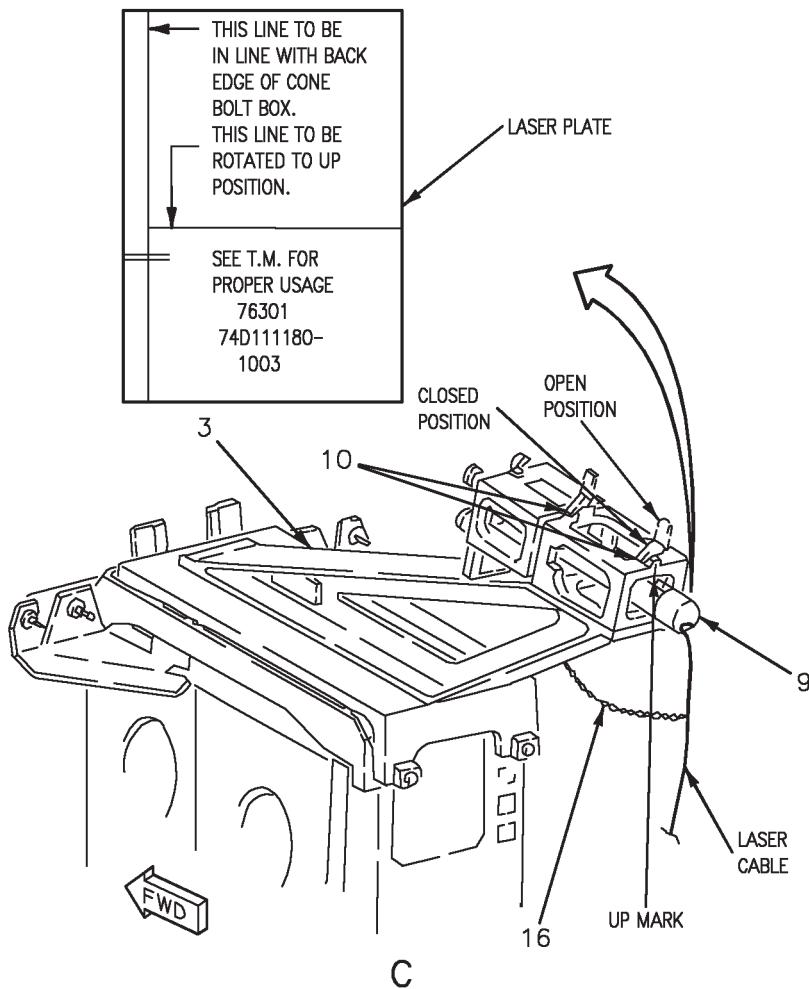
Figure 1.

18AC-LMM-04-(8-1)11-SCAN

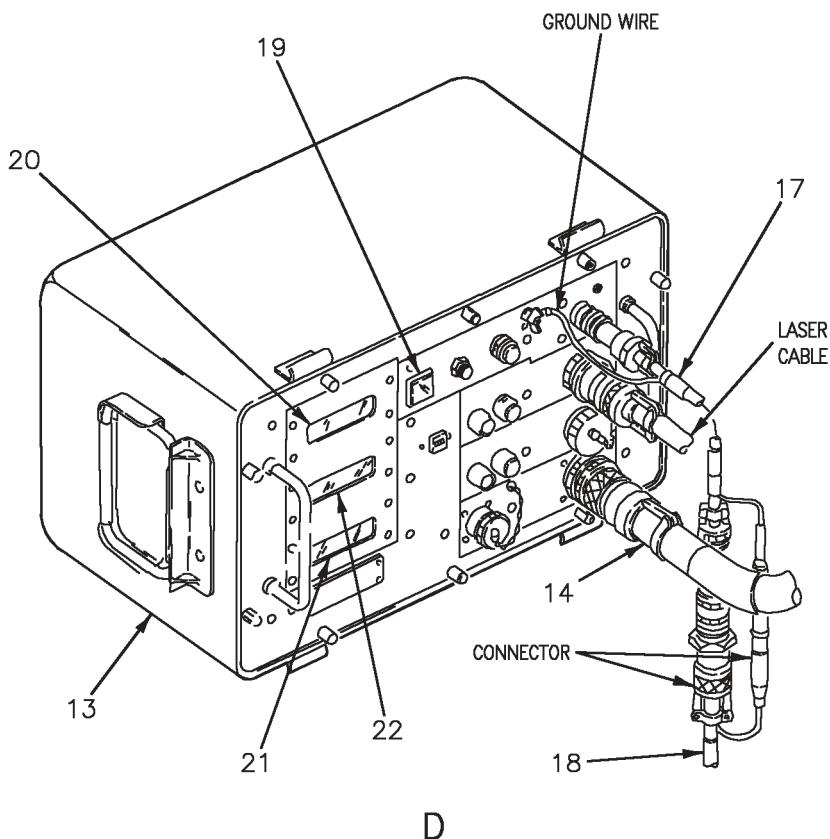


18AC-LMM-04-(8-2)11-SCAN

**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 2)**

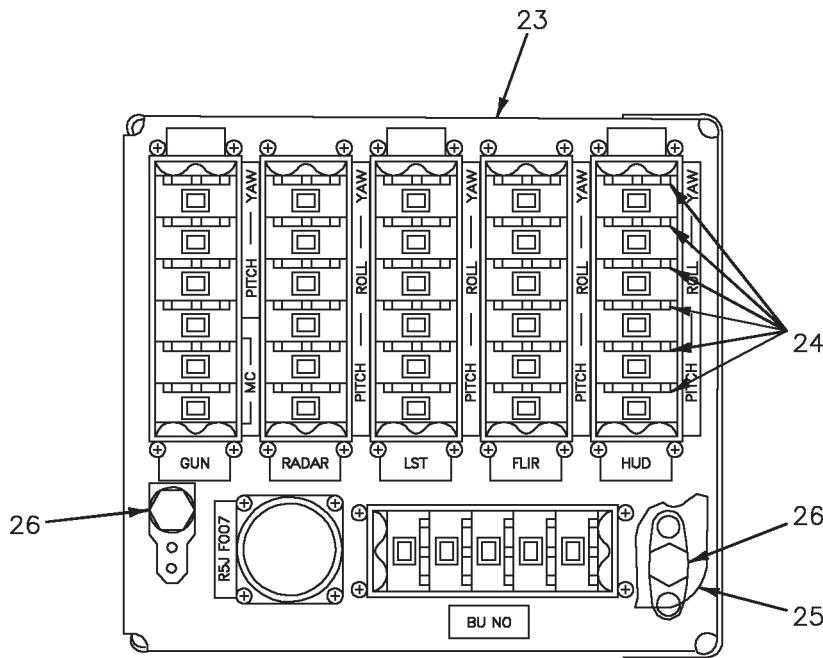


**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 3)**

**D**

18AC-LMM-04-(8-4)11-SCAN

**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 4)**



**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 5)**

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]	Boresight Reference Frame Assembly	74D111115
2 [2]	Beam Splitter Assembly	74D111159
3 [1]	Head-Up Display Mount Adapter Assy.	74D111059
4	Attach Bolt	—
5	HUD Electrical Equip. Mounting Base	74A800681
6	Alignment Pin	—
7	Stud	—
8	Attach Bolt	—
9 [2]	Laser	74D111180
10	Laser Clamp	—
11 [2]	Triaxial Detector Unit - TDU	74D111167
12	Attach Bolt	—
13 [2]	Control/Display Unit	74D111141
14 [2]	Cable	74D111145-1001
15	Chain	—
16	Chain	—
17 [2]	Cable	74D111145-1003
18 [2]	Cable	74D111145-1005
19	Switch	—
20	Pitch Display	—
21	Yaw Display	—
22	Roll Display	—
23	Electrical Boresight Compensation Assy.	74A870612
24	Thumbwheel Switch	—
25	Guard	—
26	Attach Bolt	—

**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 6)**

INDEX NO.	NOMENCLATURE	PART NUMBER
LEGEND		
[1] Part of 74D110163 boresight alignment set.		
[2] Part of 74D110021 triaxial alignment set.		

**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 7)**

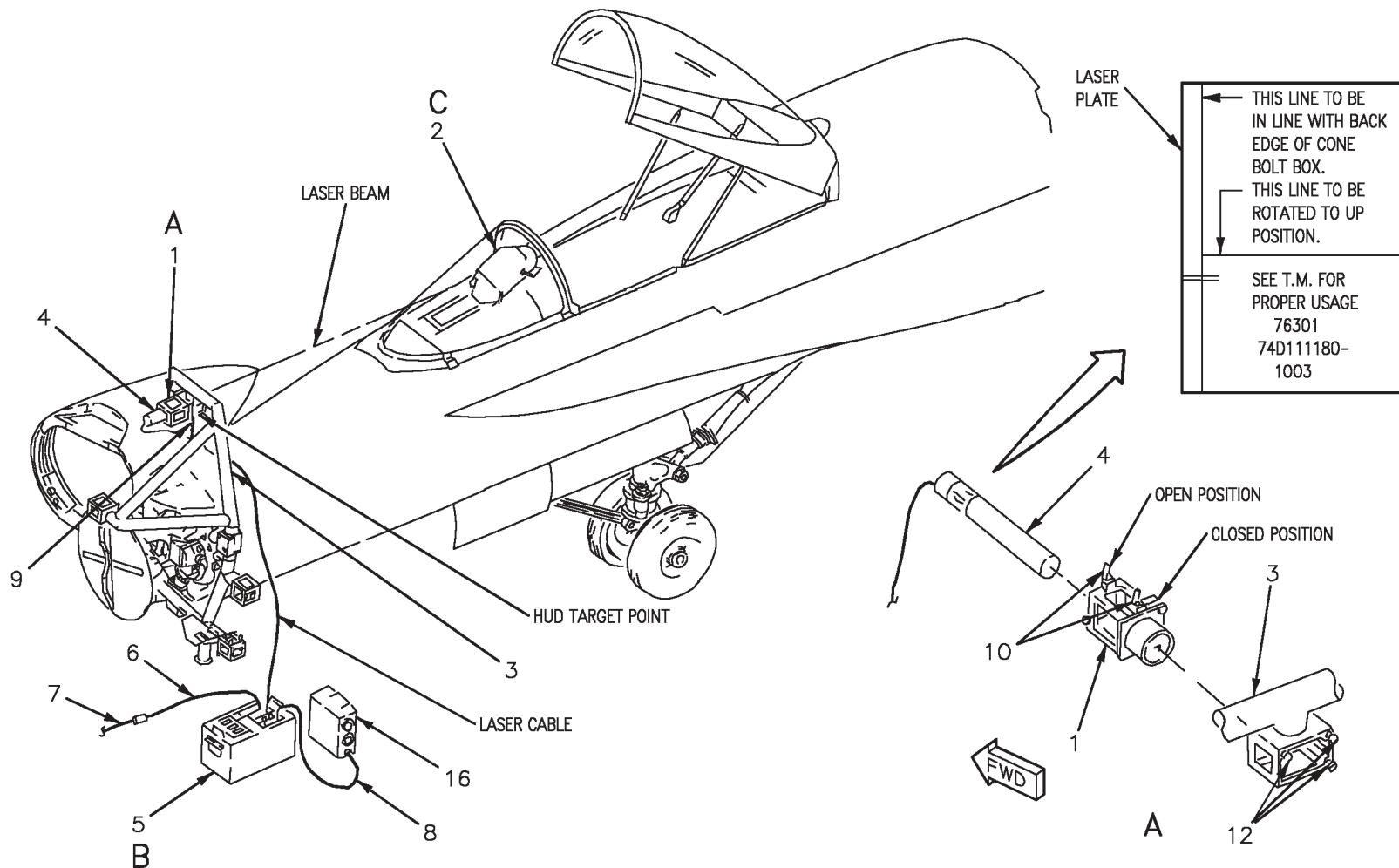
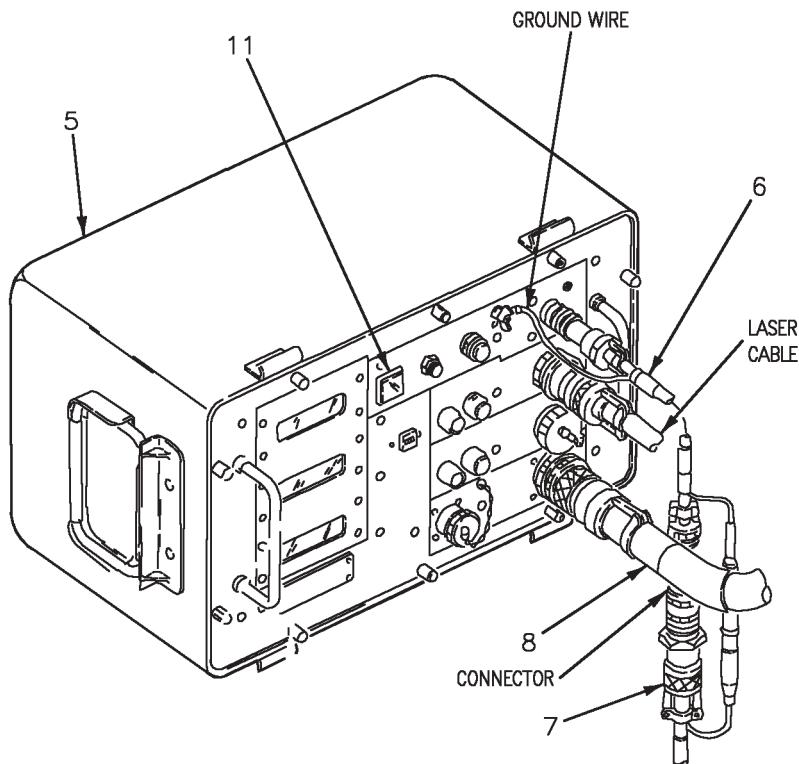


Figure 2. Head-Up Display Unit (Sheet 1)

Figure 2.

Figure 2.

18AC-I MM-04-(7-1)11-SCAN

**B**

18AC-LMM-04-(7-2)11-SCAN

Figure 2. Head-Up Display Unit (Sheet 2)

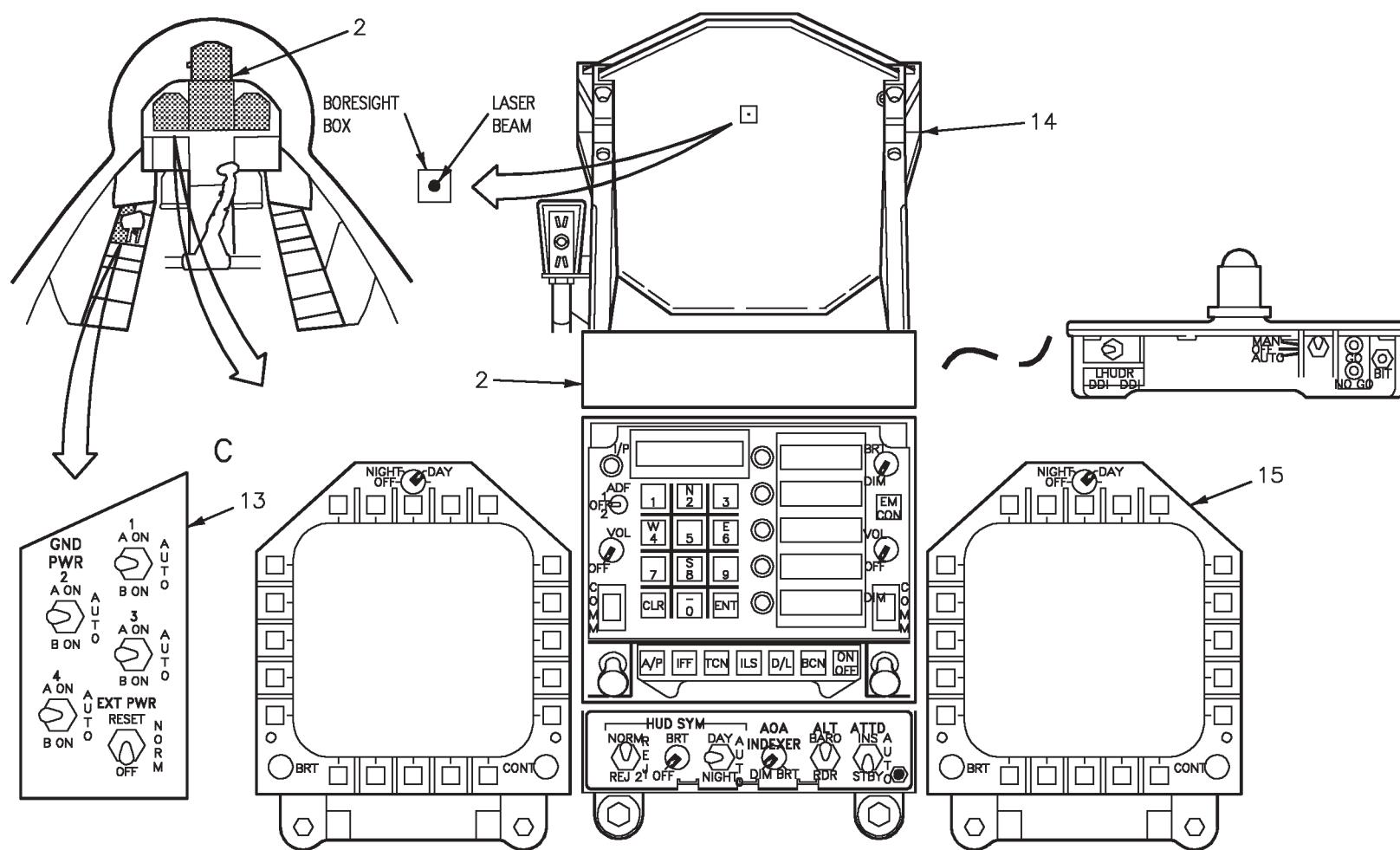


Figure 2. Head-Up Display Unit (Sheet 3)

Figure 2.

Figure 2.

18AC-LMM-04-(7-3)11-CATI

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1] ◀	HUD Adapter Assembly	74D111079
2	Head-Up Display Unit	—
3 [1] ◀	Boresight Reference Frame Assembly	74D111115
4 [2] ◀	Laser	74D111180
5 [2] ◀	Control/Display Unit	74D111141
6 [2] ◀	Cable	74D111145-1003
7 [2] ◀	Cable	74D111145-1005
8 [2] ◀	Cable	74D111145-1001
9	Chain	—
10	Laser Clamp	—
11	Switch	—
12	Attach Bolts	—
13	Ground Power Control Panel Assembly	—
14	Combiner Assembly	—
15	Right Digital Display Indicator	—
16 [2] ◀	Triaxial Detector Unit - TDU	74D111167

LEGEND

[1] ▶ Part of 74D110163 boresight alignment set.
[2] ▶ Part of 74D110021 triaxial alignment set.

Figure 2. Head-Up Display Unit (Sheet 4)

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****HEAD-UP DISPLAY UNIT****AND****ASSEMBLY OF HUD ELECTRICAL EQUIPMENT MOUNTING BASE****USING 537226 OPTICAL ALIGNMENT SET**

This WP supersedes WP004 02, dated 1 January 1995.

Reference Material

Line Maintenance Procedures.....	A1-F18AC-LMM-000
Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Communication, TACAN, ADF, Electronic Altimeter and IFF Systems.....	A1-F18AC-600-300
Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002)	WP003 00
Weapon Control Systems	A1-F18AC-740-200
Electrical Boresight Compensation System Test.....	WP040 00

Reference Material (Continued)

Weapon Control Systems	A1-F18AE-740-200
Electrical Boresight Compensation System Test.....	WP181 00
Multipurpose Display Group	A1-F18AC-745-300
Head-Up Display Unit AN/AVQ-28.....	WP003 00
Multipurpose Display Group	A1-F18AG-745-300
Head-Up Display Unit AN/AVQ-32.....	WP003 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	5
Aircraft Preparation.....	6
HUD Mount Alignment Verification/ Initial Alignment Procedure.....	6
HUD Unit Alignment Verification Procedure	13
Introduction.....	3
General Instructions.....	4
Safety Precautions.....	5

Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
SEC 4998	—	Replacement of 74D110021 Triaxial Alignment Set With 537226 Optical Alignment Set. (Alameda ECP 775)	1 Jun 93	—

1. INTRODUCTION.

2. This work package provides organizational level maintenance procedures for verifying pitch and yaw alignment of the Head-Up Display Unit (HUD) and for boresighting HUD electrical equipment mounting base (HUD Mount) located in cockpit.

3. The HUD mount alignment verification/initial alignment/realignment procedure is used to determine mount pitch, roll, yaw and to input corrective data into the electrical boresight compensation assembly. The alignment verification is used when there is an uncertainty with the installed mounts boresight accuracy or windshield has been replaced. The initial alignment is used when existing mount is removed and reinstalled or a new mount is installed.

NOTE

The HUD unit alignment verification is not a substitute for the HUD mount alignment verification.

4. The HUD unit alignment verification is used to verify pitch and yaw alignment of the HUD as an operating system following alignment and verification of the HUD mount. If HUD unit is not within allowable tolerances, the HUD unit must be replaced.

5. **GENERAL INSTRUCTIONS.** To make sure mount is accurately boresighted, the instructions below shall be used:

a. Due to equipment sensitivity, boresighting should only be done ashore.

b. Personnel must be familiar with the use and operation of the optical alignment set.

c. Personnel must know the principles of boresighting.

d. Boresighting should be done separately from other maintenance operations.

e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.

f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.

g. Attach bolts shall be clean and free of burrs and damaged threads.

- h. Visually inspect for loose or missing sealant around nuts on equipment.
- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

6. SAFETY PRECAUTIONS.

- a. Be sure aircraft ground safety-ejection control handle/aircraft canopy jettison pins are installed (A1-F18AC-PCM-000).
- b. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

7. AIRCRAFT BORESIGHT REQUIREMENTS.

- 8. Aircraft structural flexing affects boresight accuracy. To control the effect of this flexing and to be sure the boresight is accurate, make sure the aircraft is as listed below:

- a. Make sure all armament, avionics, electrical equipment and ballast is installed.
- b. Make sure ammunition drum is empty.
- c. Make sure windshield is closed.
- d. Make sure no loose tools and/or equipment are in cockpit.
- e. Make sure door 3 is closed (A1-F18AC-LMM-010).
- f. No other specific requirements are necessary.

9. AIRCRAFT PREPARATION.

a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

b. Clean windshield (A1-F18AC-PCM-000).

10. HUD MOUNT ALIGNMENT VERIFICATION/INITIAL ALIGNMENT/REALIGNMENT PROCEDURE. See figure 1.**Support Equipment Required**

Part Number or Type Designation	Nomenclature
--	---------------------

74D110163-1001	Boresight Alignment Set
537226	Optical Alignment Set
—	Torque Wrench, 0 to 150 Inch-Pounds

Materials Required

Specification or Part Number	Nomenclature
-------------------------------------	---------------------

CCC-C-440 TYPE 1, CLASS 1	Cheesecloth
P-D-680, TYPE 2	Dry Cleaning Solvent

a. Verify alignment of optical alignment set (WP010 02).

- b. Set up and install boresight reference frame assembly (BRFA) (1) (WP009 00).
- c. Remove Head-Up Display Unit (A1-F18AC-745-300, WP003 00 or A1-F18AG-745-300, WP003 00).

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- d. Clean attach points on optical reference measurement unit (2) and HUD alignment box (15) using clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

- e. Visually inspect attach points to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- f. Make sure attach bolts are clean and free of burrs and damaged threads.
- g. Lift optical reference measurement unit (2) by its carrying handle, hold against HUD alignment box (15) attach points.

- h. Engage and snug two upper attach bolts first, then the lower attach bolt.
- i. Hand tighten all three attach bolts (9) the same amount.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- j. Clean attach points on target mirror assembly (4), HUD mount adapter (16) and HUD mount (17) using clean cheesecloth moistened with solvent.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

- k. Visually inspect attach points to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- l. Make sure two alignment pins (18) are clean and free of burrs.
- m. Make sure attach bolts (10) and (11) are clean and free of burrs.
- n. Connect cable (7) to optical target monitor (3) and target mirror assembly (4).

- o. Position target mirror assembly (4) on HUD mount adapter (16) attach points.
- p. Engage and snug two upper attach bolts first, then the lower attach bolt.
- q. Hand tighten all three attach bolts (10) the same amount.
- r. Install HUD mount adapter (16) on HUD mount (17) per substeps below:



To prevent damage to windshield, be careful when installing HUD mount adapter.

- (1) Slide HUD mount adapter (16) forward onto two alignment pins (18) and over two studs (19).
- (2) Install HUD mount adapter two attach bolts (11) in the internally threaded studs (19). Initially torque bolts to 45 ± 5 inch-pounds. Continue to torque bolts sequentially in 10 inch-pound increments to 75 ± 5 inch-pounds.
- s. Position optical target monitor (3) close to optical reference measurement unit (2) so video display (8) may be viewed while adjusting pitch and yaw micrometers (13) and (14).
- t. Connect cable (6) to optical target monitor (3) and optical reference measurement unit (2).
- u. Connect power cable (5) to optical target monitor (3).

- v. Plug power cable (5) to electrical power source.

NOTE

Do not adjust roll setting potentiometer (25).

- w. Switch optical target monitor power switch (12) to ON and do substeps below:

- (1) Adjust brightness control (30) to maximum brightness, detail F.

- (2) Adjust focus control (31) as required for best focus of cross hairs, detail G.

NOTE

Due to optical light beam penetrating windshield, target crosshairs may appear dim.

- x. View video display (8) for crosshair position on target rings. If required, adjust pitch and yaw micrometers (13) and (14) by rotating pitch and yaw micrometer spindles (23) and (24) to get centering of crosshairs on target rings.

NOTE

The mount pitch, roll, and yaw indications are displayed in 0.01 milliradian increments.

- y. Read and record plus-minus PITCH (20), ROLL (21), and YAW (22) display indications from optical target monitor (3). Record indications to nearest 0.5 milliradian.

- z. Switch optical target monitor power switch (12) to OFF.

NOTE

Electrical boresight compensation assembly has a range from -7.5 to +7.5 milliradians.

- aa. If HUD mount pitch, roll, and yaw indications are between -7.5 and +7.5 milliradians, the electrical boresight compensation assembly (26) shall be used to correct the misalignment. Go to next step. Indications below -7.5 or above +7.5 milliradians require an depot engineering disposition.

- ab. Open door 13R (A1-F18AC-LMM-010).

- ac. Remove aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

NOTE

Electrical boresight compensation assembly has a plus-minus thumbwheel switch and a milliradian thumbwheel switch for each of the HUD pitch, roll, and yaw indications.

- ad. Read and record electrical boresight compensation assembly (26) HUD plus-minus PITCH, ROLL, and YAW thumbwheel switch (29) settings.

- ae. If the HUD plus-minus PITCH, ROLL, and YAW thumbwheel switch settings are not the same as new boresight indications, go to next step. If they are the same, go to step ak.

- af. Remove guard (27) from electrical boresight compensation assembly (26) by removing attach bolts (28).

NOTE

When inputting data into the electrical boresight compensation assembly, ignore existing recorded data. Adjust the thumbwheel switches, until the applicable plus or minus sign and milliradian numbers are displayed in the switch windows. When inputting data into the HUD thumbwheel switches, do not change the other system thumbwheel switch settings as it will cause the affected system to have the wrong boresight compensation data.

- ag. Input new boresight settings into electrical boresight compensation assembly (26) HUD plus-minus PITCH, ROLL, and YAW thumbwheel switches (29).

- ah. Record new HUD thumbwheel switch (29) settings on Miscellaneous History Card OPNAV 4790/25A, part of the Aircraft Log Book.

NOTE

Setting GUN-MC thumbwheel switch is a factory adjustment and should not be changed.

- ai. Verify GUN-MC thumbwheel switch on electrical boresight compensation assembly (26) is set on +2.0 for 161353 THRU 161987 or +2.5 for 162394 AND UP.

- aj. Install guard (27) with attach bolts (28).

- ak. Install aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).
 - al. Inspect door 13R for foreign objects.
 - am. Close door 13R (A1-F18AC-LMM-010).
 - an. Disconnect cable (7) from optical target monitor (3) and target mirror assembly (4).
 - ao. Remove HUD mount adapter (16) from HUD mount (17) per substeps below:

- (1) Remove two attach bolts (11).



To prevent damage to windshield, be careful when removing HUD mount adapter.

- (2) Slide HUD mount adapter (16) aft off of alignment pins (18) and studs (19).
- ap. Remove target mirror assembly (4) from HUD mount adapter (16) by removing three attach bolts (10).
- aq. Install Head-Up Display Unit (A1-F18AC-745-300, WP003 00 or A1-F18AG-745-300, WP003 00).
- ar. Do HUD UNIT ALIGNMENT VERIFICATION, this WP.

11. HUD UNIT ALIGNMENT VERIFICATION PROCEDURE.

See figure 2.

NOTE

If HUD misalignment is suspected , HUD MOUNT ALIGNMENT VERIFICATION procedure should always be done before doing HUD UNIT ALIGNMENT VERIFICATION procedure, because it is not known if HUD unit or HUD mount is misaligned.

Support Equipment Required

Part Number or Type Designation	Nomenclature
74D110163-1001	Boresight Alignment Set
537226	Optical Alignment Set

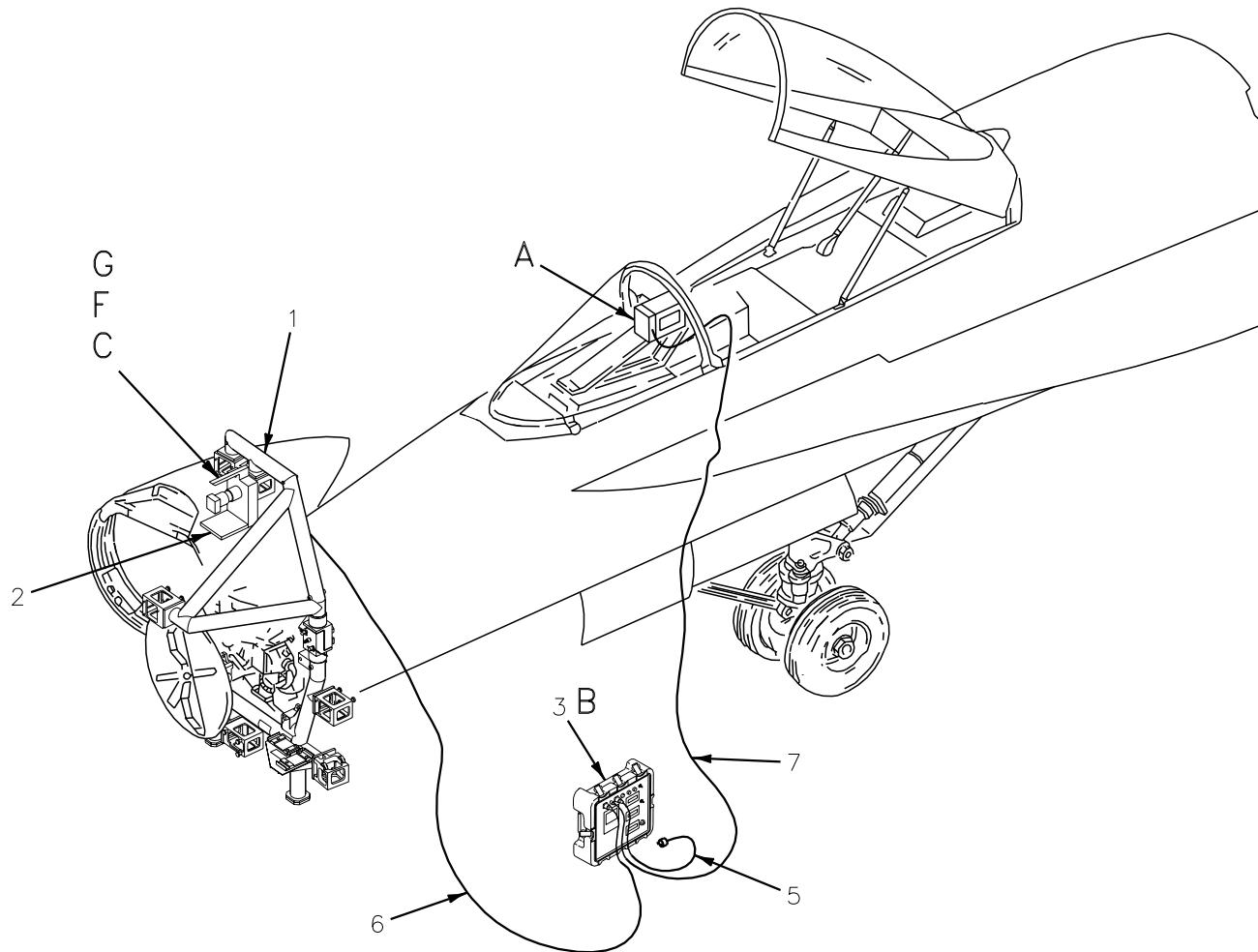
Materials Required

None

- a. Apply electrical power (A1-F18AC-LMM-000).
- b. On GND PWR control panel assembly (10), set 1 switch to A ON and 2 switch to B ON.
- c. On right digital display indicator (RDDI) (12), set OFF/NIGHT/AUTO/DAY switch to AUTO.
- d. Turn on HUD unit (9) by setting HUD SYM - BRT control to center position. Allow 2 minutes warm up.

- e. Set HUD unit (9) DAY/AUTO/NIGHT switch to either DAY or NIGHT, as required, for ambient light conditions.
- f. Adjust HUD unit (9) HUD SYM - BRT control for best display on combiner assembly (11).
- g. Adjust RDDI (12) BRT and CONT controls for best display on RDDI.
- h. On RDDI (12), press MENU pushbutton switch.
- i. On RDDI (12), press BIT pushbutton switch.
- j. On RDDI (12), press DISP/EPI/UFC pushbutton switch.
Combiner assembly (11) has test pattern with boresight box displayed.
- k. Switch optical target monitor power switch (7) to ON.
- l. Adjust pitch and yaw micrometers (figure 1, index 13) and (14) to zero by rotating pitch and yaw micrometer spindles (23) and (24) to get 0.00 display reading on pitch and yaw digital displays (20) and (22).
- m. Determine if HUD symbology is aligned with BRFA (figure 2, index 1) HUD target point per substeps below:
 - (1) Assume pilots normal position in cockpit.
 - (2) Looking through combiner assembly (11), determine if target crosshairs are within the boresight box displayed on combiner assembly.
 - (3) If target crosshairs are within boresight box, the HUD unit is aligned within alignment tolerance, complete this procedure. If target crosshairs are not within boresight box the HUD unit should be replaced.

- n. Switch optical target monitor power switch (7) to OFF.
- o. On RDDI (12), press STOP pushbutton switch.
- p. On HUD unit (9), turn HUD SYM - BRT control to OFF.
- q. On RDDI (12), set OFF/NIGHT/AUTO/DAY switch to OFF.
- r. On GND PWR control panel assembly (10), set 1 and 2 switches to AUTO.
- s. Remove electrical power (A1-F18AC-LMM-000).
- t. Do electrical boresight compensation system test
(A1-F18AC-740-200, WP040 00 or A1-F18AE-740-200, WP181 00).
- u. Inspect cockpit for foreign objects.
- v. Unplug power cable (5) from electrical power source.
- w. Disconnect power cable (5) from optical target monitor (3).
- x. Disconnect cable (6) from optical target monitor (3) and optical reference measurement unit (2).
- y. Remove optical reference measurement unit (2) from HUD alignment box (8) by removing three attach bolts (4).
- z. Replace all boresighting equipment to proper storage areas.
 - aa. If all boresighting is completed, remove and stow BRFA (1) (WP009 00).
 - ab. If all boresighting is completed, remove safety devices, as required (A1-F18AC-PCM-000).

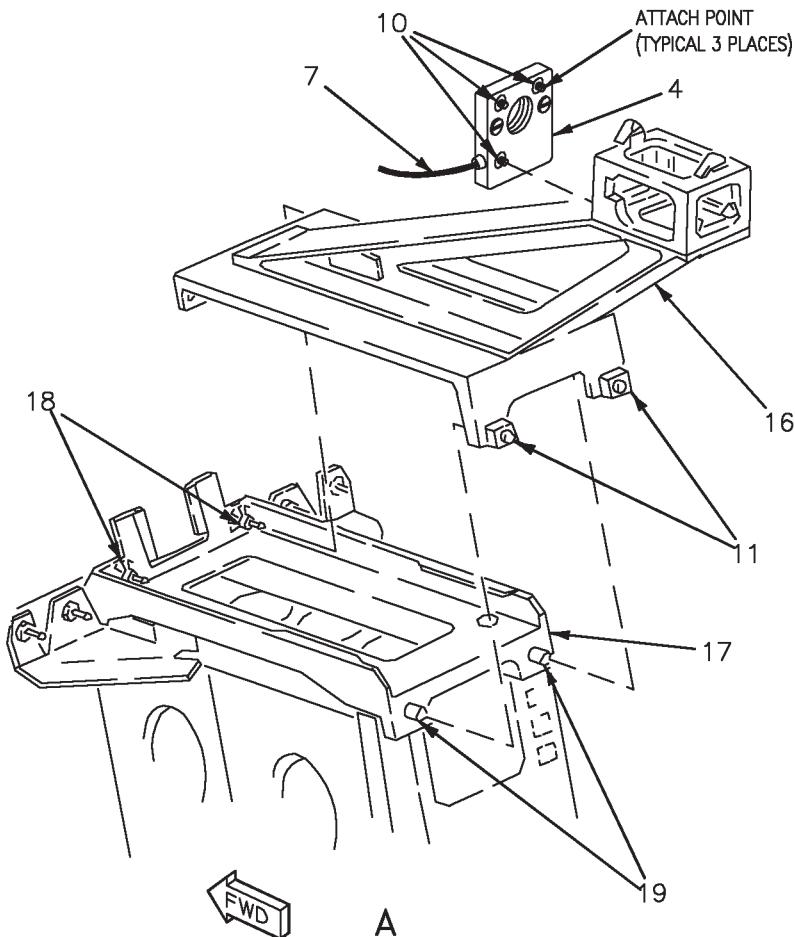


**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 1)**

Figure 1.

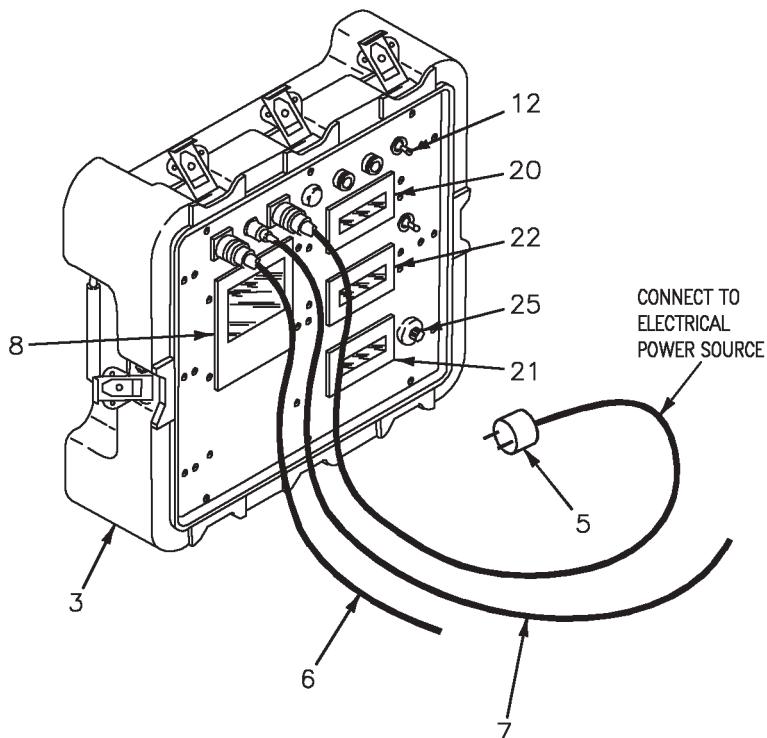
18AC-LMM-04-(17-1)14-CATI

Figure 1.



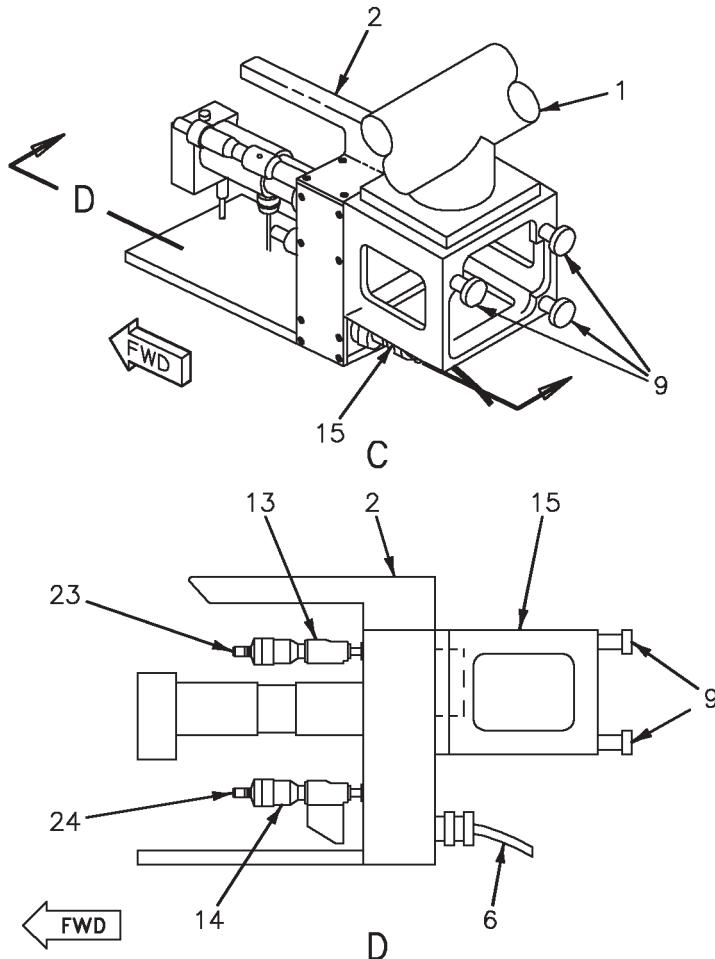
1BAC-LMM-04-(17-2)11-SCAN

**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 2)**

**B**

18AC-LMM-04-(17-3)11-SCAN

**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 3)**



18AC-LMM-04-(17-4)11-SCAN

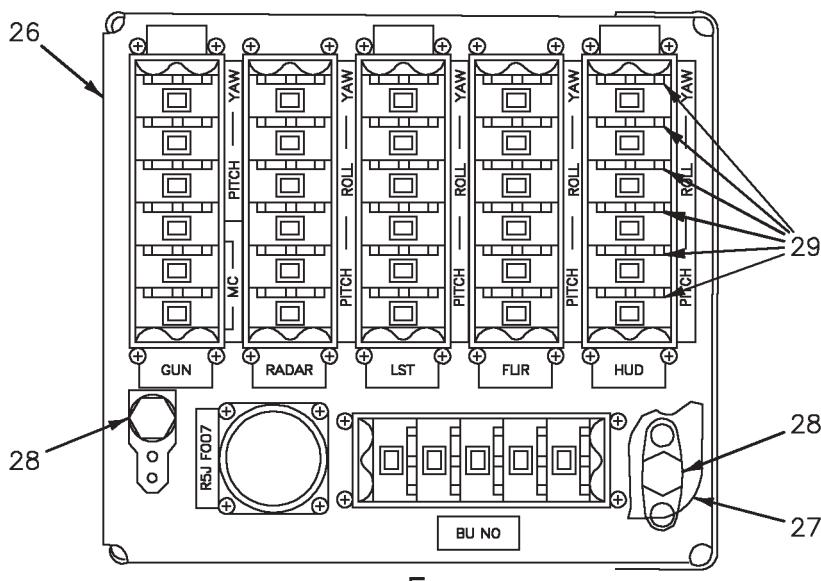
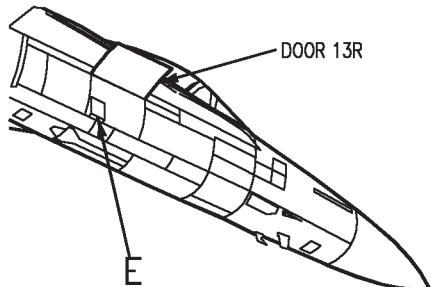
**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 4)**

A1-F18AC-LMM-040

Change 3

004 02

Page 21



18AC-LMM-04-(17-5)11-CATI

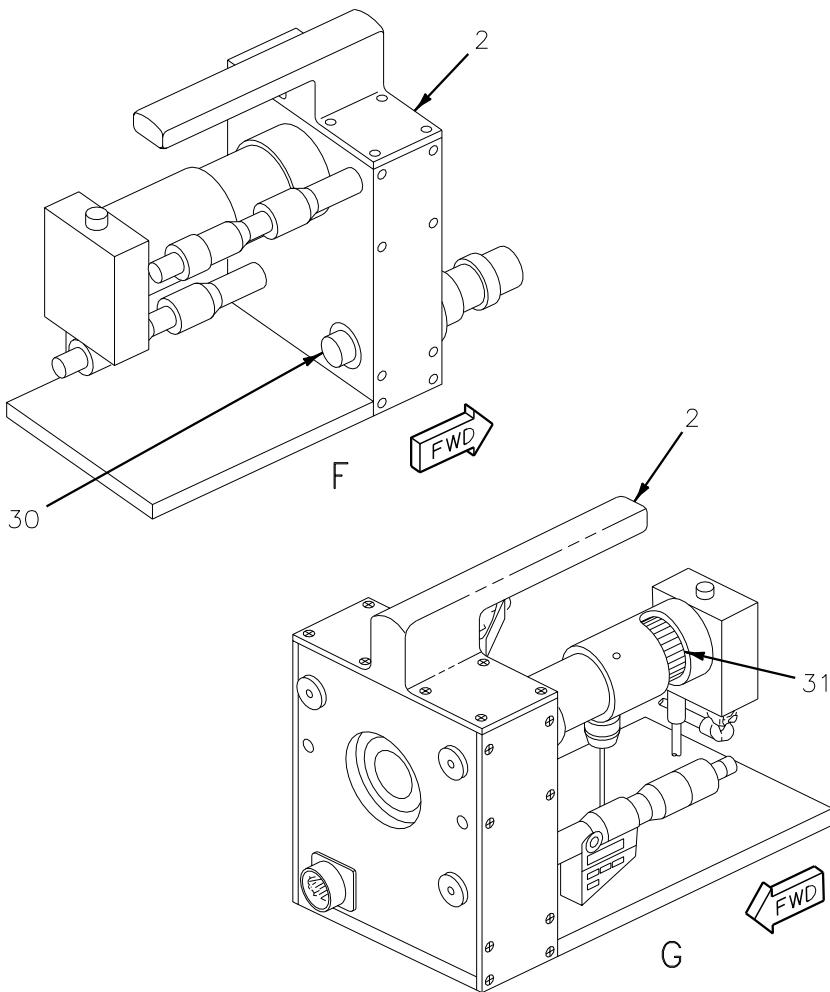
**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 5)**

A1-F18AC-LMM-040

Change 3

004 02

Page 22



18AC-LMM-04-(17-6)14-CATI

**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 6)**

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]▶	Boresight Reference Frame Assembly	74D111115
2 [2]▶	Optical Reference Measurement Unit	537227
3 [2]▶	Optical Target Monitor	437228
4 [2]▶	Target Mirror Assembly	437232
5 [2]▶	Power Cable	437230-1
6 [2]▶	Cable	437230-2
7 [2]▶	Cable	437230-3
8	Video Display	—
9	Attach Bolts	—
10	Attach Bolts	—
11	Attach Bolts	—
12	Power Switch	—
13	Pitch Micrometer	—
14	Yaw Micrometer	—
15	HUD Alignment Box	—
16 [1]▶	HUD Mount Adapter	74D111059
17	HUD Mount	74A800681
18	Alignment Pin	—
19	Stud	—
20	Digital Display, Pitch	—
21	Digital Display, Roll	—
22	Digital Display, Yaw	—
23	Micrometer Spindle, Pitch	—
24	Micrometer Spindle, Yaw	—
25	Roll-Adjust Zero Potentiometer	—
26	Electrical Boresight Compensation Assy.	74A870612

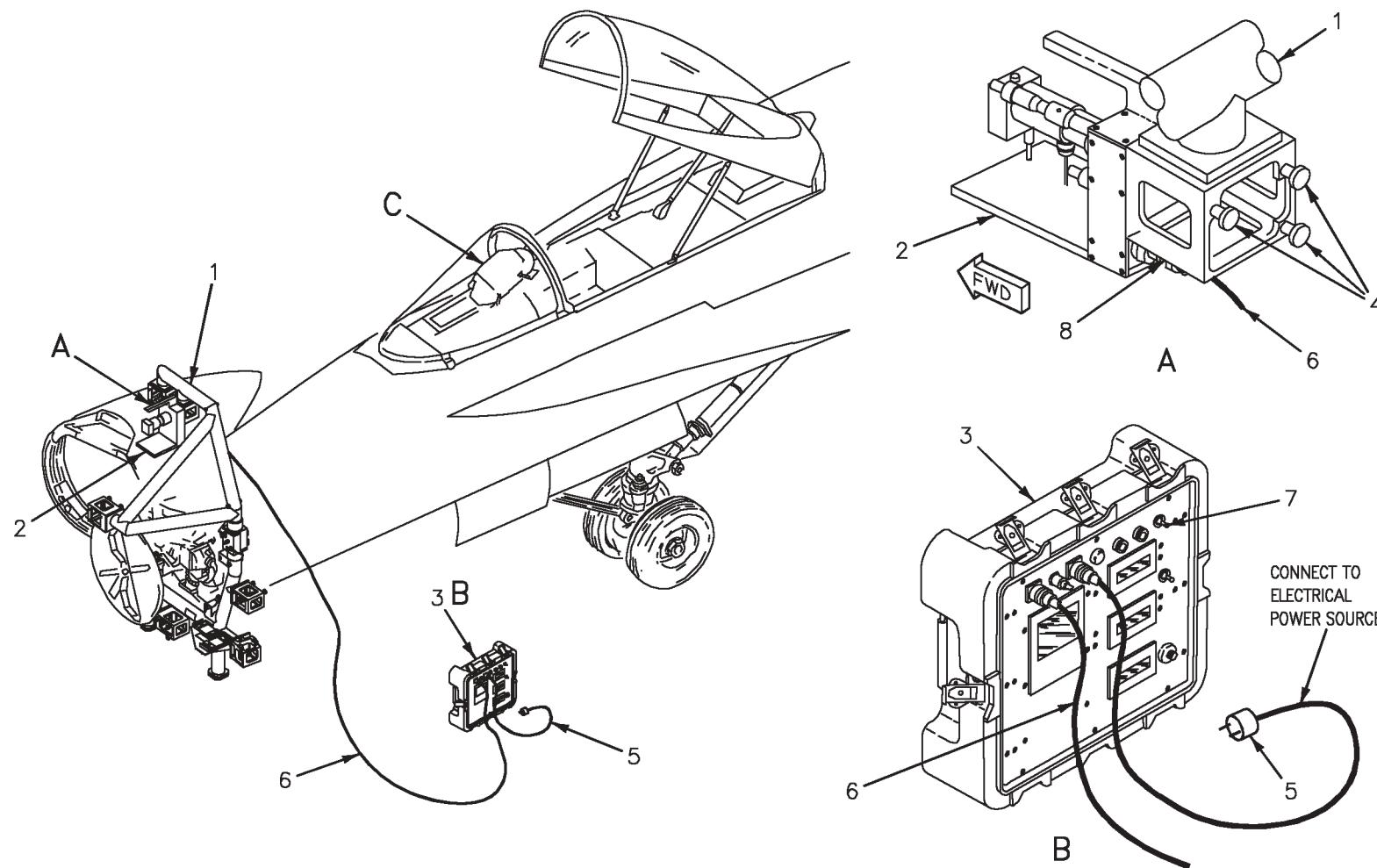
**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 7)**

INDEX NO.	NOMENCLATURE	PART NUMBER
27	Guard	74A880682
28	Attach Bolts	—
29	HUD Thumbwheel Switch	—
30	Brightness Control	—
31	Focus Control	—

LEGEND

[1] Part of 74D110163 boresight alignment set.
[2] Part of 537226 optical alignment set.

**Figure 1. Head-Up Display Unit Mounting Base
(Sheet 8)**

**Figure 2. Head-Up Display Unit (Sheet 1)****Figure 2.**

18AC-LMM-04-(18-1)11-SCAN

Figure 2.

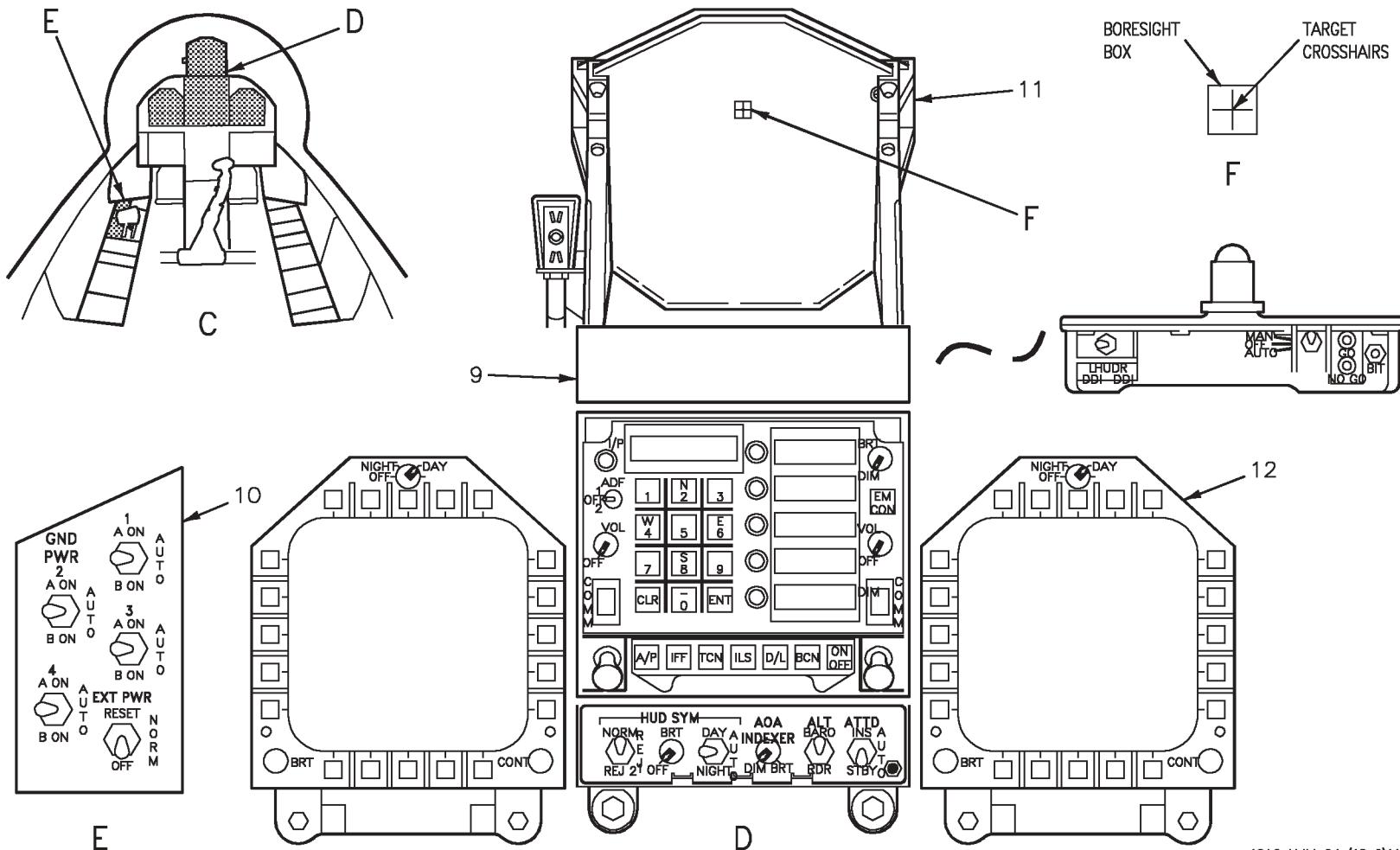


Figure 2. Head-Up Display Unit (Sheet 2)

Figure 2.

Figure 2.

18AC-LMM-04-(18-2)11-CATT

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]▶	Boresight Reference Frame Assembly	74D111115
2 [2]▶	Optical Reference Measurement Unit	537227
3 [2]▶	Optical Target Monitor	437228
4	Attach Bolts	—
5 [2]▶	Power Cable	437230-1
6 [2]▶	Cable	437230-2
7	Power Switch	—
8	HUD Alignment Box	—
9	Head-Up Display Unit	—
10	GND PWR Control Panel Assembly	—
11	Combiner Assembly	—
12	Right Digital Display Indicator	—

LEGEND

[1]▶ Part of 74D110163 boresight alignment set.
[2]▶ Part of 537226 optical alignment set.

Figure 2. Head-Up Display Unit (Sheet 3)

A1-F18AC-LMM-040

Change 1 - 1 April 1994

005 00

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ORGANIZATIONAL MAINTENANCE

LINE MAINTENANCE BORESIGHTING DATA

ANTENNA, RADAR SET

This WP supersedes WP005 00, dated 1 June 1993.

Title	WP Number
Antenna, Radar Set	
Using 74D110021 Triaxial Alignment Set	005 01
Using 537226 Optical Alignment Set	005 02

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****ANTENNA, RADAR SET****USING 74D110021 TRIAXIAL ALIGNMENT SET**

Reference Material

Line Maintenance Procedures	A1-F18AC-LMM-000
Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Communication, TACAN, ADF, Electronic	
Altimeter and IFF Systems.....	A1-F18AC-600-300
Receiver-Transmitter	
RT-1250/ARC-182(V)) (76A-F002)	WP003 00
Testing and Troubleshooting, Radar System.....	A1-F18AC-742-200
Troubleshooting Procedures - Part III.....	WP009 00
Radar System.....	A1-F18AC-742-300
Antenna AS-3254/APG-65 (60E-A501)	WP008 00
Radar System.....	A1-F18AH-742-300
Antenna AS-3254/APG-73 (60E-A501)	WP008 00
Weapon Control Systems	A1-F18AC-740-200
Electrical Boresight Compensation	
System Test.....	WP040 00

Reference Material (Continued)

Weapon Control Systems	A1-F18AE-740-200
Electrical Boresight Compensation System Test.....	WP181 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	4
Aircraft Preparation.....	4
Alignment Verification/Alignment Procedure.....	4A
Introduction.....	2
General Instructions.....	2
Safety Precautions.....	4

Record of Applicable Technical Directives

None

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for boresighting the radar antenna located in the forward fuselage.

3. **GENERAL INSTRUCTIONS.** To make sure the radar antenna is accurately boresighted, the instructions below shall be used:

- a. Due to equipment sensitivity, boresighting should only be done ashore.
- b. Personnel must be familiar with the use and operation of the triaxial alignment set.
- c. Personnel must know the principles of boresighting.
- d. Boresighting should be done separately from other maintenance operations.
- e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
- f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.
- g. Attach bolts shall be clean and free of burrs and damaged threads.
- h. Visually inspect for loose or missing sealant around nuts on equipment.
- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

4. SAFETY PRECAUTIONS.**WARNING**

Laser radiation, do not look into laser beams or eye injury could occur.

- a. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

5. AIRCRAFT BORESIGHT REQUIREMENTS.

- a. Aircraft structural flexing affects boresight accuracy. To control the effect of this flexing and to be sure the boresight is accurate, make sure the aircraft is as listed below:

- (1) Make sure all armament, avionics, electrical equipment and/or ballast is installed.
 - (2) Make sure gun ammunition drum is empty.
 - (3) Make sure door 3 is closed (A1-F18AC-LMM-010).

- b. Radar antenna troubleshooting procedures should be done before boresighting. Do target not in target designator box procedures (A1-F18AC-742-200, WP009 00). |

6. AIRCRAFT PREPARATION.

- a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

7. ALIGNMENT VERIFICATION/ALIGNMENT PROCEDURE.

See figure 1.

Support Equipment Required

Part Number or Type Designation	Nomenclature
74D110163-1001 (74D110028-1001)	Boresight Alignment Set (Radar Antenna Alignment Adapter)
74D110021-1003 (74D110021-1001) —	Triaxial Alignment Set
	Torque Wrench, 0 to 50 Inch-Pounds

Materials Required

Specification or Part Number	Nomenclature
CCC-C-440 TYPE 1, CLASS 1	Cheesecloth
P-D-680, TYPE 2	Dry Cleaning Solvent

- a. Verify alignment of triaxial alignment set (WP010 01).

WARNING

Make sure external electrical power is removed from aircraft, or personal injury and/or damage to radar antenna may occur.

- b. Make sure electrical power is off (A1-F18AC-LMM-000).
- c. Set up and install boresight reference frame assembly (BRFA) (WP009 00).
- d. Lock planar array in boresight position per substeps below:



Do not use force to engage elevation and azimuth boresight pins in the boresight locks, as damage may occur.

- (1) Position planar array in elevation, press the elevation boresight pin (8) until it engages the elevation boresight lock (9), then turn it clockwise until it locks.
- (2) Position planar array in azimuth, press azimuth boresight pin (10) until it engages azimuth boresight lock (11), then turn it clockwise until it locks.

**WARNING**

Dry cleaning solvent is flammable and toxic. Do not use near open flame or sparks. Avoid breathing vapors. Do not allow contact with skin or eyes. Use only in well ventilated areas.

- e. Clean mating surfaces of radar alignment adapter (7), antenna gimbal (2), 74D111167 triaxial detector unit (TDU) (4), 74D111159 beam splitter assembly (5), and BRFA (1) using cheesecloth moistened with solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

- f. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- g. Make sure attach bolts (13), (16), and (17) are clean and free of burrs and damaged threads.
- h. Position radar alignment adapter (7) on antenna gimbal (2) and alignment pins (12)
 - i. Install three attach bolts (13). Torque attach bolts 20 to 25 inch-pounds.
 - j. Lift TDU (4) by its carrying handle, hold against BRFA (1) at radar antenna target point.
 - k. Engage and snug two upper attach bolts first, then the lower attach bolt.
 - l. Hand tighten all three attach bolts (17) the same amount.
 - m. Lift beam splitter (5) by the box frame near the top and hold against radar alignment adapter (7).
 - n. Engage and snug two upper attach bolts first, then the lower attach bolt.
 - o. Hand tighten all three attach bolts (16) the same amount.

p. Install 74D111180 laser (6) in radar alignment adapter (7) per substeps below:

- (1) Wipe all oil and fingerprints from steel tube using a clean cheesecloth.
- (2) Open two laser clamps (14).
- (3) Slide laser (6) aft into radar alignment adapter (7) until line on laser plate is aligned with forward edge of radar alignment adapter.
- (4) Rotate laser (6) to align line on laser plate with up mark on radar alignment adapter (7).
- (5) Close two laser clamps (14).

NOTE

Misalignment of lines can degrade boresight accuracy.

(6) Verify that line on laser (6) is still aligned with mark on radar alignment adapter (7).

NOTE

Failure to hook chain may degrade boresight accuracy.

(7) Hook chain (23) to radar alignment adapter (7).

NOTE

Failure to hook chain may degrade boresight accuracy.

q. Hook chain (15) to BRFA (1).

WARNING

Laser radiation, do not look into laser beams or eye injury could occur.

NOTE

The main laser light will illuminate when control/display unit is turned on. When laser energy is not sensed by the TDU after approximately 15 seconds, it will inhibit the laser, causing the main laser light to go off.

- r. Press control/ display unit switch (22) to ON position.

NOTE

The radar antenna pitch, roll, and yaw indications are displayed on the control/display unit. The PITCH, ROLL, and YAW displays are graduated in 0.01 milliradian increments. Because of equipment sensitivity, five indications should be taken, then use the average of these indications for alignment correction.

Normal equipment operation will allow the displayed ROLL reading to fluctuate as much as ± 0.50 milliradians about a median value. Operator judgement should be used to determine this median roll value.

s. Read plus-minus PITCH (19), ROLL (21), and YAW (20) display indications on control/display unit (3). Record indications to the nearest 0.5 milliradian.

t. Push control/display unit (3) switch (22) to off position.

NOTE

Electrical boresight compensation assembly has a range from -7.5 to +7.5 milliradians.

u. If the radar antenna pitch, roll, and yaw indications are between -7.5 and +7.5 milliradians, the electrical boresight compensation assembly (26) shall be used to correct the misalignment. Go to next step. If indications are below -7.5 or above +7.5 milliradians, remove boresight equipment and replace antenna (A1-F18AC-742-300, WP008 00 or A1-F18AH-742-300, WP008 00), and repeat steps b through u. If indications remain below -7.5 or above +7.5 milliradians, a depot engineering disposition is required.

v. Open door 13R (A1-F18AC-LMM-010).

w. Remove aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

x. Read and record electrical boresight compensation assembly (26) RADAR, plus-minus PITCH, ROLL, and YAW thumbwheel switch (29) settings.

y. If RADAR settings are the same as the new boresight indications, go to step af. If not the same, go to next step.

NOTE

Do not turn electrical boresight compensation assembly other system thumbwheel switches as it will cause the affected system to have the wrong boresight compensation data.

- z. Remove guard (28) from electrical boresight compensation assembly (26) by removing attach bolts (27).

NOTE

When inputting data into the electrical boresight compensation assembly, ignore any existing recorded data. Adjust the plus-minus and milliradian thumbwheel switches until the applicable plus or minus sign and milliradian number are displayed in the switch windows.

- aa. Input radar antenna plus-minus pitch, roll, and yaw milliradian indications into the electrical boresight compensation assembly (26) RADAR plus-minus PITCH, ROLL, and YAW thumbwheel switches (29).
- ab. Record new thumbwheel switch (29) settings on Miscellaneous History Card OPNAV 4790/25A, part of the Aircraft Log Book.

NOTE

Setting GUN-MC thumbwheel switch is a factory adjustment and should not be changed.

ac. Verify GUN-MC thumbwheel switch on electrical boresight compensation assembly (26) is set on +2.0 for 161353 THRU 161987 or +2.5 for 162394 AND UP.

ad. Do electrical boresight compensation system test (A1-F18AC-740-200, WP040 00 or A1-F18AE-740-200, WP181 00).

ae. Install guard (28) with attach bolts (27).

af. Install aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

ag. Inspect door 13R for foreign objects.

ah. Close door 13R (A1-F18AC-LMM-010).

ai. Remove laser (6) from radar alignment adapter (7) per substeps below:

(1) Unhook chain (23) from radar alignment adapter (7).

(2) Open two laser clamps (14).

(3) Slide laser (6) forward out of radar alignment adapter (7) and install on check fixture.

(4) Close two laser clamps (14).

aj. Remove beam splitter assembly (5) from radar alignment adapter (7) by removing three attach bolts (16) and install on check fixture.

ak. Remove TDU (4) from BRFA (1) by removing three attach bolts (17) and install on check fixture.

al. Remove radar alignment adapter (7) from radar antenna gimbal (2) by removing three attach bolts (13).



Failure to unlock radar antenna planar array can cause damage to antenna.

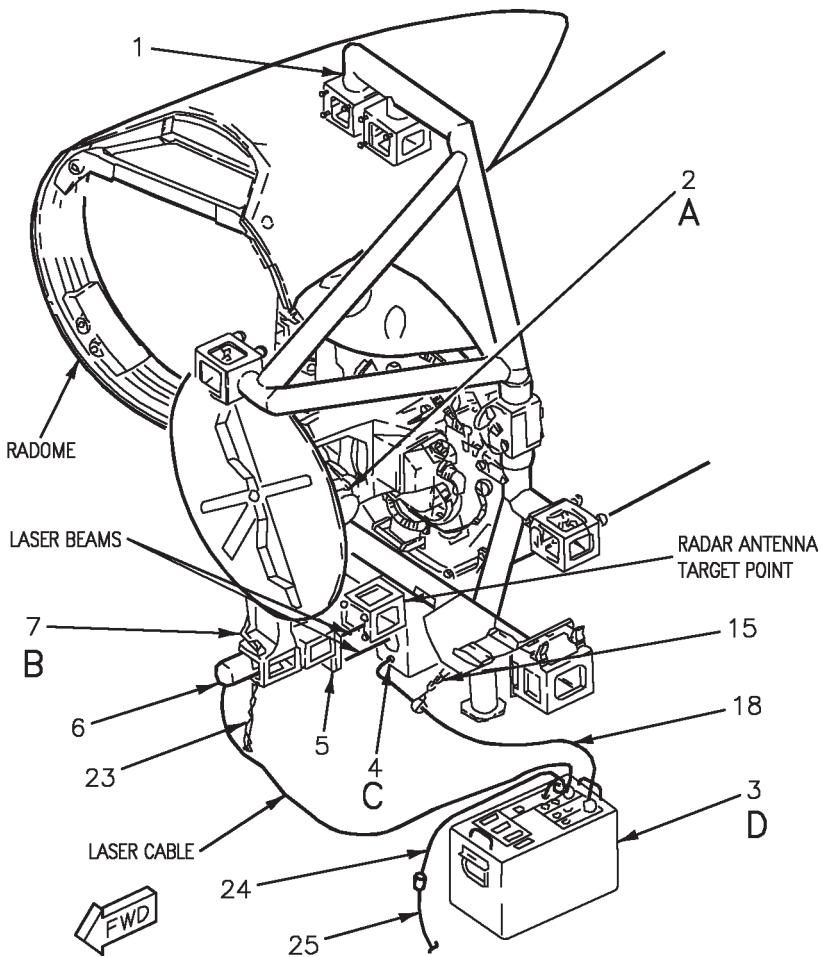
am. Unlock radar antenna planar array from boresight position per substeps below:

(1) Turn azimuth boresight pin (10) counterclockwise until it unlocks, then disengage it from azimuth boresight lock (11).

(2) Support planar array and turn elevation boresight pin (8) counterclockwise until it unlocks, then disengage it from elevation boresight lock (9).

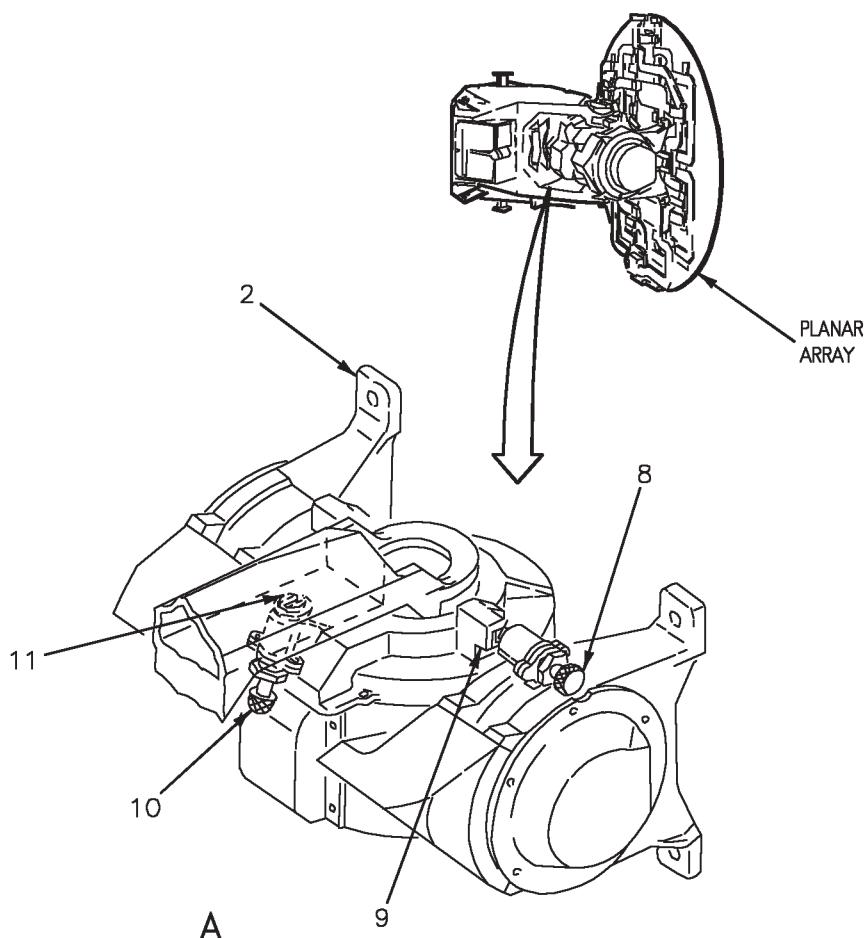
an. If all boresighting is completed, remove and stow BRFA (WP009 00).

ao. If all boresighting is completed, remove safety devices, as required (A1-F18AC-PCM-000).



18AC-LMM-04-(10-1)11-SCAN

Figure 1. Radar Antenna (Sheet 1)

**Figure 1. Radar Antenna (Sheet 2)**

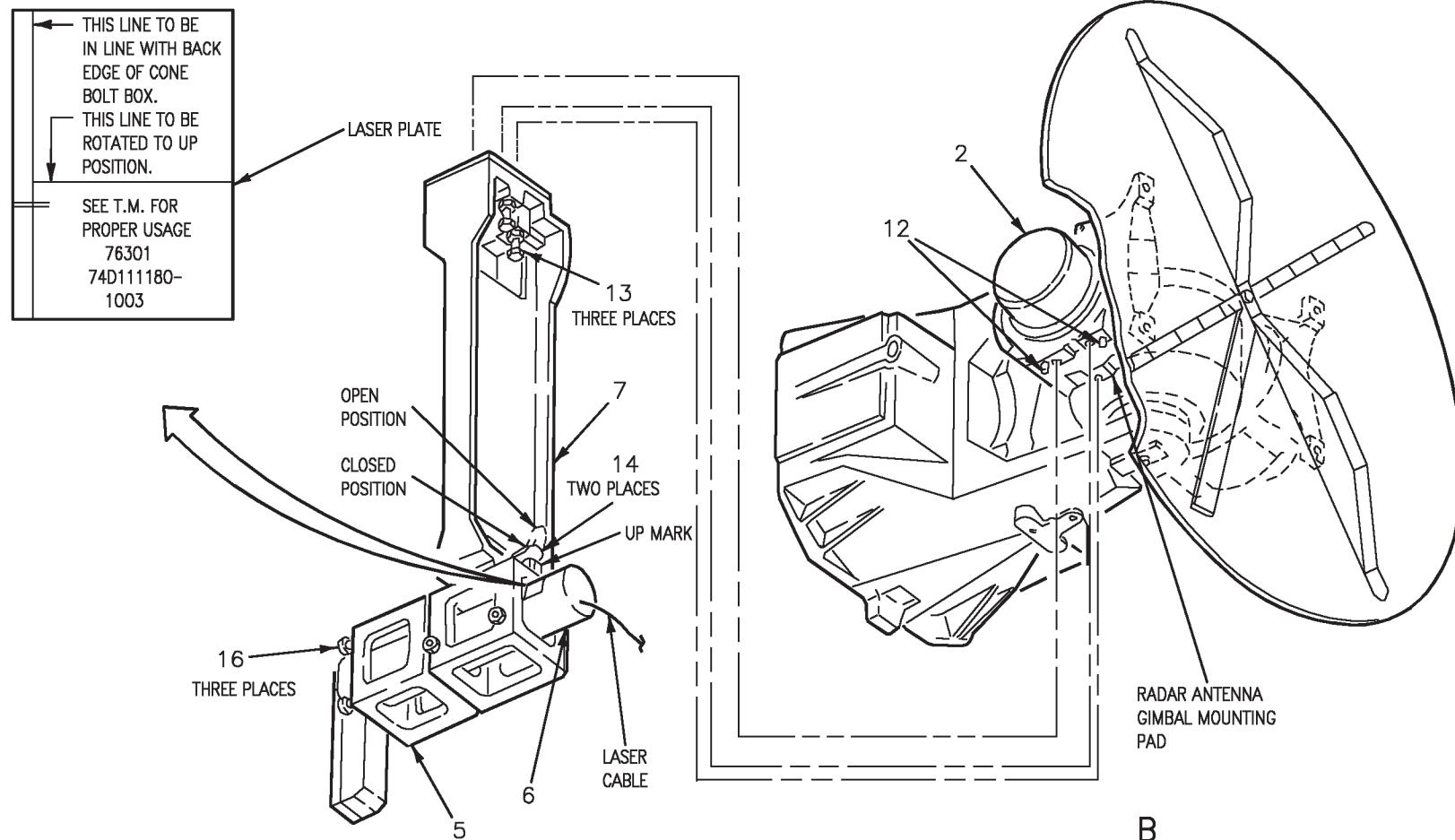
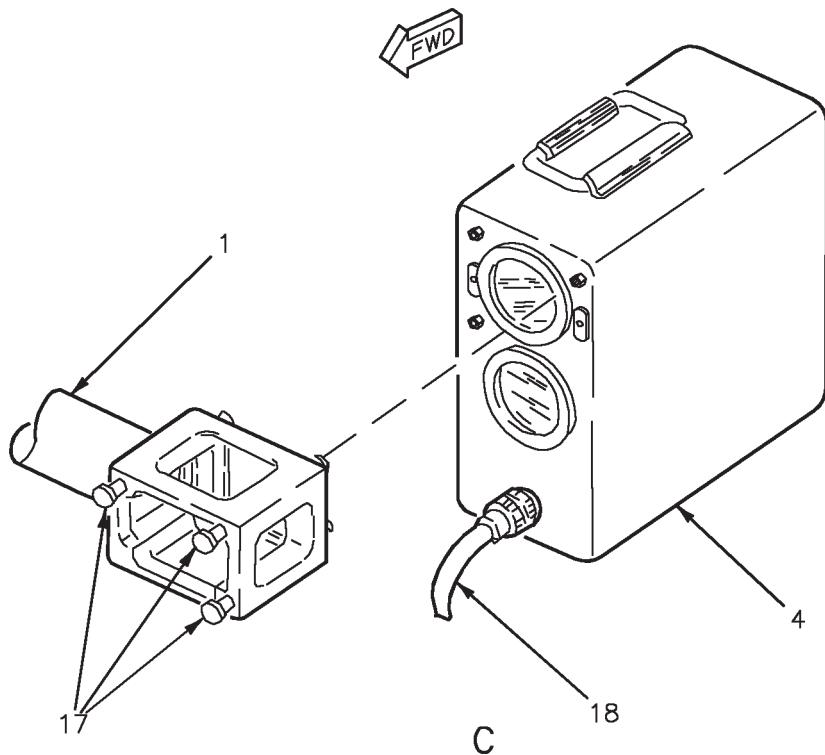


Figure 1. Radar Antenna (Sheet 3)

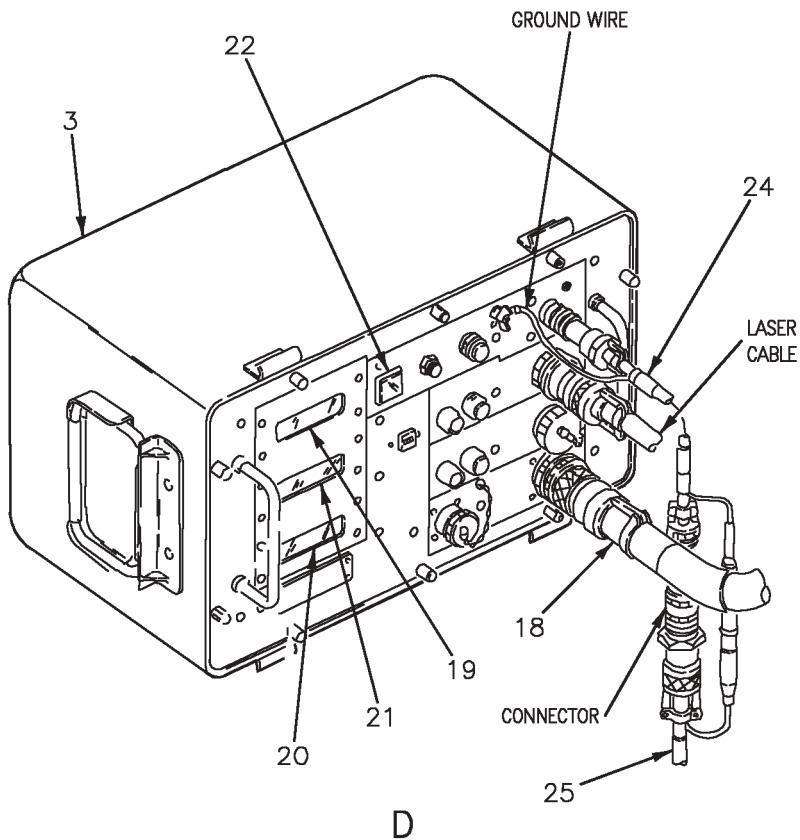
Figure 1.

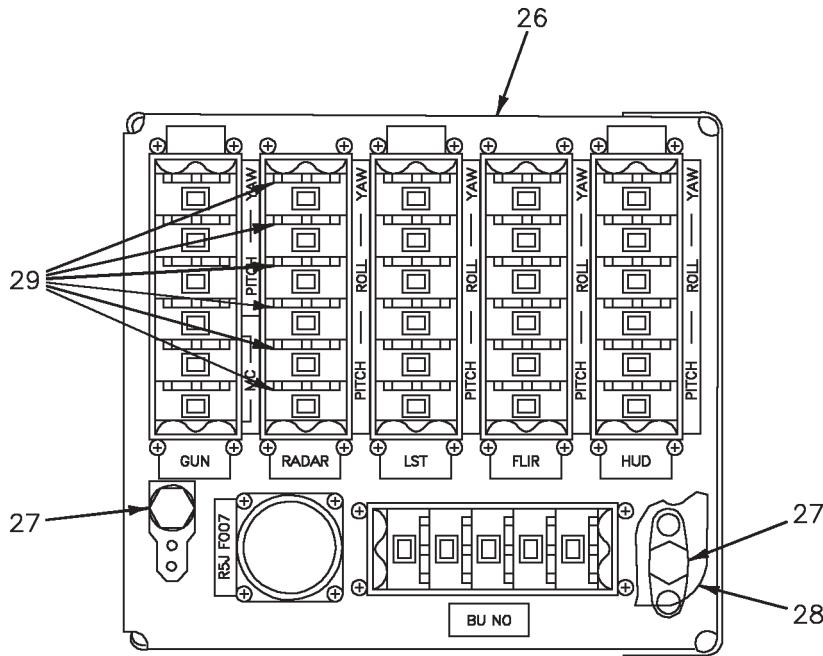
Figure 1.



18AC-LMM-04-(10-4)11-SCAN

Figure 1. Radar Antenna (Sheet 4)



**Figure 1. Radar Antenna (Sheet 6)**

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]	Boresight Reference Frame Assembly	74D111115
2	Antenna Gimbal	—
3 [2]	Control/Display Unit	74D111141
4 [2]	Triaxial Detector Unit - TDU	74D111167
5 [2]	Beam Splitter Assembly	74D111159
6 [2]	Laser	74D111180
7 [2]	Radar Antenna Alignment Adapter	74D111084
8	Elevation Boresight Pin	—
9	Elevation Boresight Lock	—
10	Azimuth Boresight Pin	—
11	Azimuth Boresight Lock	—
12	Alignment Pin	—
13	Attach Bolt	—
14	Laser Clamp	—
15	Chain	—
16	Attach Bolt	—
17	Attach Bolt	—
18 [2]	Cable	74D111145-1001
19	Pitch Display	—
20	Yaw Display	—
21	Roll Display	—
22	Switch	—
23	Chain	—
24 [2]	Cable	74D111145-1003
25 [2]	Cable	74D111145-1005
26	Electrical Boresight Compensation Assy.	74A870612

Figure 1. Radar Antenna (Sheet 7)

A1-F18AC-LMM-040

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INDEX NO.	NOMENCLATURE	PART NUMBER
27	Attach Bolt	—
28	Guard	—
29	Thumbwheel Switch	—

LEGEND

[1] Part of 74D110163 boresight alignment set.

[2] Part of 74D110021 triaxial alignment set.

Figure 1. Radar Antenna (Sheet 8)

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****ANTENNA, RADAR SET****USING 537226 OPTICAL ALIGNMENT SET**

Reference Material

Line Maintenance Procedures	A1-F18AC-LMM-000
Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Communication, TACAN, ADF, Electronic	
Altimeter and IFF Systems.....	A1-F18AC-600-300
Receiver-Transmitter	
RT-1250/ARC-182(V)) (76A-F002)	WP003 00
Testing and Troubleshooting, Radar System.....	A1-F18AC-742-200
Troubleshooting Procedures - Part III.....	WP009 00
Radar System.....	A1-F18AC-742-300
Antenna AS-3254/APG-65 (60E-A501)	WP008 00
Radar System.....	A1-F18AH-742-300
Antenna AS-3254/APG-73 (60E-A501)	WP008 00
Weapon Control Systems	A1-F18AC-740-200
Electrical Boresight Compensation	
System Test.....	WP040 00

Reference Material (Continued)

Weapon Control Systems	A1-F18AE-740-200
Electrical Boresight Compensation System Test.....	WP181 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	4
Aircraft Preparation.....	4
Alignment Verification Procedure	4
Introduction.....	3
General Instructions.....	3
Safety Precautions.....	4

Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
SEC 4998	—	Replacement of 74D110021 Triaxial Alignment Set With 537226 Optical Alignment Set. (Alameda ECP 775)	1 Jun 93	—

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for boresighting the radar antenna located in the forward fuselage.

3. **GENERAL INSTRUCTIONS.** To make sure the radar antenna is accurately boresighted, the instructions below shall be used:

- a. Due to equipment sensitivity, boresighting should only be done ashore.
- b. Personnel must be familiar with the use and operation of the optical alignment set.
- c. Personnel must know the principles of boresighting.
- d. Boresighting should be done separately from other maintenance operations.
- e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
- f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.
- g. Attach bolts shall be clean and free of burrs and damaged threads.
- h. Visually inspect for loose or missing sealant around nuts on equipment.
- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

4. SAFETY PRECAUTIONS.

- a. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

5. AIRCRAFT BORESIGHT REQUIREMENTS.

- a. Aircraft structural flexing affects boresight accuracy. To control the effect of this flexing and to be sure the boresight is accurate, make sure the aircraft is as listed below:

- (1) Make sure all armament, avionics, electrical equipment and/or ballast is installed.
- (2) Make sure gun ammunition drum is empty.
- (3) Make sure door 3 is closed (A1-F18AC-LMM-010).

- b. Radar antenna troubleshooting procedures should be done before boresighting. Do target not in target designator box procedures (A1-F18AC-742-200, WP009 00). 

6. AIRCRAFT PREPARATION.

- a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

7. ALIGNMENT VERIFICATION PROCEDURE. See figure 1.

Support Equipment Required

Part Number or Type Designation	Nomenclature
--	---------------------

74D110163-1001	Boresight Alignment Set
537226	Optical Alignment Set
—	Torque Wrench, 0 to 50 Inch-Pounds

Materials Required

Specification or Part Number	Nomenclature
---	---------------------

CCC-C-440 TYPE 1, CLASS 1	Cheesecloth
P-D-680, TYPE 2	Dry Cleaning Solvent

- a. Verify alignment of optical alignment set (WP010 02).

WARNING

Make sure external electrical power is removed from aircraft, or personal injury and/or damage to radar antenna may occur.

- b. Make sure electrical power is off (A1-F18AC-LMM-000).

- c. Set up and install boresight reference frame assembly (BRFA) (1) (WP009 00).
- d. Lock planar array in boresight position per substeps below:



Do not use force to engage elevation and azimuth boresight pins in the boresight locks, as damage may occur.

(1) Position planar array in elevation, press the elevation boresight pin (26) until it engages the elevation boresight lock (27), then turn it clockwise until it locks.

(2) Position planar array in azimuth, press azimuth boresight pin (28) until it engages azimuth boresight lock (29), then turn it clockwise until it locks.



Dry cleaning solvent is flammable and toxic. Do not use near open flame or sparks. Avoid breathing vapors. Do not allow contact with skin or eyes. Use only in well ventilated areas.

e. Clean attach points on radar antenna alignment adapter (9), antenna gimbal (10), optical reference measurement unit (2), target mirror assembly (4) and radar alignment box (15) using clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

- f. Visually inspect attach points to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- g. Make sure attach bolts (17), (18), and (19) are clean and free of burrs and damaged threads.
- h. Position radar antenna alignment adapter (9) on antenna gimbal (10) and alignment pins (11).
- i. Install three attach bolts (17). Torque attach bolts 20 to 25 inch-pounds.
- j. Lift optical reference measurement unit (2) by its carrying handle, hold against radar alignment box (15).
- k. Engage and snug two upper attach bolts first, then the lower attach bolt.
- l. Hand tighten all three attach bolts (18) the same amount.

NOTE

Make sure connector on target mirror assembly (4) is facing inboard when installing on radar antenna alignment adapter (9).

- m. Position target mirror assembly (4) on radar antenna alignment adapter (9) attach points.

- n. Engage and snug two upper attach bolts first, then the lower attach bolt.
- o. Hand tighten all three attach bolts (19) the same amount.
- p. Position optical target monitor (3) close to optical reference measurement unit (2) so video display (8) may be viewed while adjusting pitch and yaw micrometers (13) and (14).
- q. Connect cable (6) to optical target monitor (3) and optical reference measurement unit (2).
- r. Connect cable (7) to optical target monitor (3) and target mirror assembly (4).
- s. Connect power cable (5) to optical target monitor (3).
- t. Plug power cable (5) to electrical power source.
- u. Switch optical target monitor power switch (12) to ON.

NOTE

Do not adjust roll setting potentiometer (16).

- v. View video display (8) for crosshair position on target rings. If required, adjust pitch and yaw micrometers (13) and (14) by rotating pitch and yaw micrometer spindles (21) and (22) to get centering of crosshairs on target rings.
- w. Read and record plus-minus PITCH (23), ROLL (24), and YAW (25) display indications from optical target monitor (3). Record indications to the nearest 0.5 milliradian.

- x. Switch optical target monitor power switch (12) to OFF.

NOTE

Electrical boresight compensation assembly has a range from -7.5 to +7.5 milliradians.

- y. If the radar antenna pitch, roll, and yaw indications are between -7.5 and +7.5 milliradians, the electrical boresight compensation assembly (30) shall be used to correct the misalignment. Go to next step. If indications are below -7.5 or above +7.5 milliradians, remove boresight equipment and replace antenna (A1-F18AC-742-300, WP008 00 or A1-F18AH-742-300, WP008 00), and repeat steps b through y. If indications remain below -7.5 or above +7.5 milliradians, a depot engineering disposition is required.
- z. Open door 13R (A1-F18AC-LMM-010).
- aa. Remove aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).
- ab. Read and record electrical boresight compensation assembly (30) RADAR, plus-minus PITCH, ROLL, and YAW thumbwheel switch (31) settings.
- ac. If RADAR settings are the same as the new boresight indications, go to step aj. If not the same, go to next step.

NOTE

Do not turn electrical boresight compensation assembly other system thumbwheel switches as it will cause the affected system to have the wrong boresight compensation data.

- ad. Remove guard (32) from electrical boresight compensation assembly (30) by removing attach bolts (20).

NOTE

When inputting data into the electrical boresight compensation assembly, ignore any existing recorded data. Adjust the plus-minus and milliradian thumbwheel switches until the applicable plus or minus sign and milliradian number are displayed in the switch windows.

- ae. Input radar antenna plus-minus pitch, roll, and yaw milliradian indications into the electrical boresight compensation assembly (30) RADAR plus-minus PITCH, ROLL, and YAW thumbwheel switches (31).

- af. Record new thumbwheel switch (31) settings on Miscellaneous History Card OPNAV 4790/25A, part of the Aircraft Log Book.

NOTE

Setting GUN-MC thumbwheel switch is a factory adjustment and should not be changed.

ag. Verify GUN-MC thumbwheel switch on electrical boresight compensation assembly (30) is set on +2.0 for 161353 THRU 161987 or +2.5 for 162394 AND UP.

ah. Do electrical boresight compensation system test (A1-F18AC-740-200, WP040 00 or A1-F18AE-740-200, WP181 00).

ai. Install guard (32) with attach bolts (20).

aj. Install aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

ak. Inspect door 13R for foreign objects.

al. Close door 13R (A1-F18AC-LMM-010).

am. Unplug power cable (5) from electrical power source.

an. Disconnect power cable (5) from optical target monitor (3).

ao. Disconnect cable (7) from optical target monitor (3) and target mirror assembly (4).

ap. Disconnect cable (6) from optical target monitor (3) and optical reference measurement unit (2).

aq. Remove target mirror assembly (4) from radar antenna alignment adapter (9).

- ar. Remove optical reference measurement unit (2) from radar alignment box (15).
- as. Remove radar antenna alignment adapter (9) from radar antenna gimbal (10) by removing three attach bolts (17).

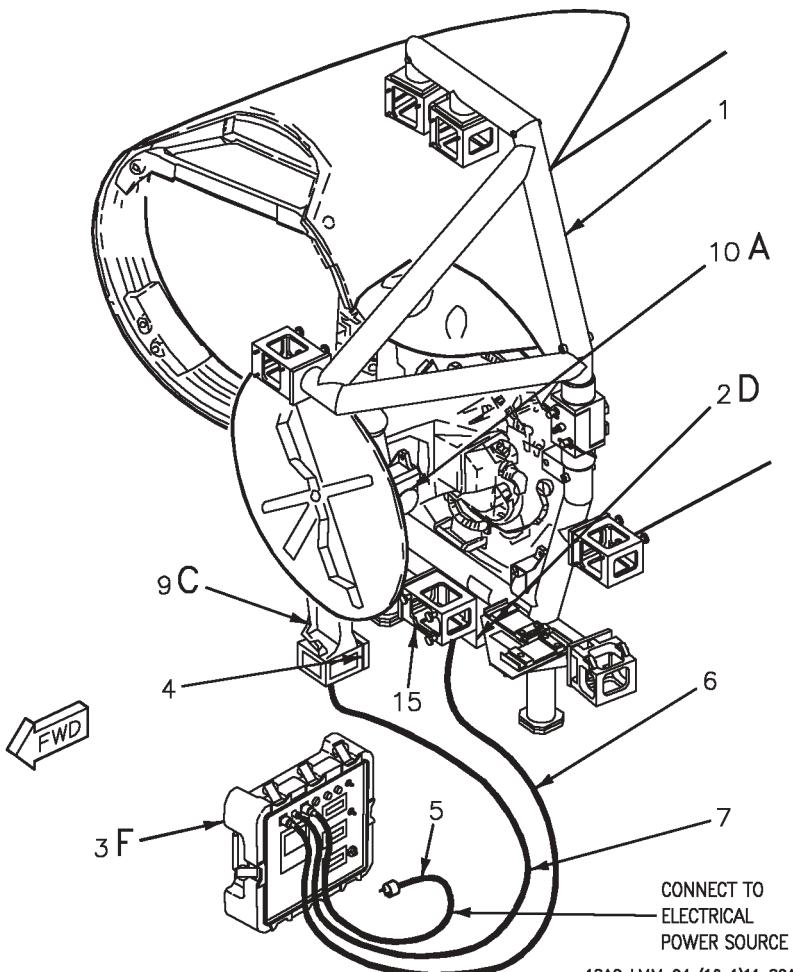


Failure to unlock radar antenna planar array can cause damage to antenna.

- at. Unlock radar antenna planar array from boresight position per substeps below:

- (1) Turn azimuth boresight pin (28) counterclockwise until it unlocks, then disengage it from azimuth boresight lock (29).
- (2) Support planar array and turn elevation boresight pin (26) counterclockwise until it unlocks, then disengage it from elevation boresight lock (27).

- au. Replace all boresighting equipment to proper storage areas.
- av. If all boresighting is completed, remove and stow BRFA (1) (WP009 00).
- aw. If all boresighting is completed, remove safety devices, as required (A1-F18AC-PCM-000).

**Figure 1. Radar Antenna (Sheet 1)**

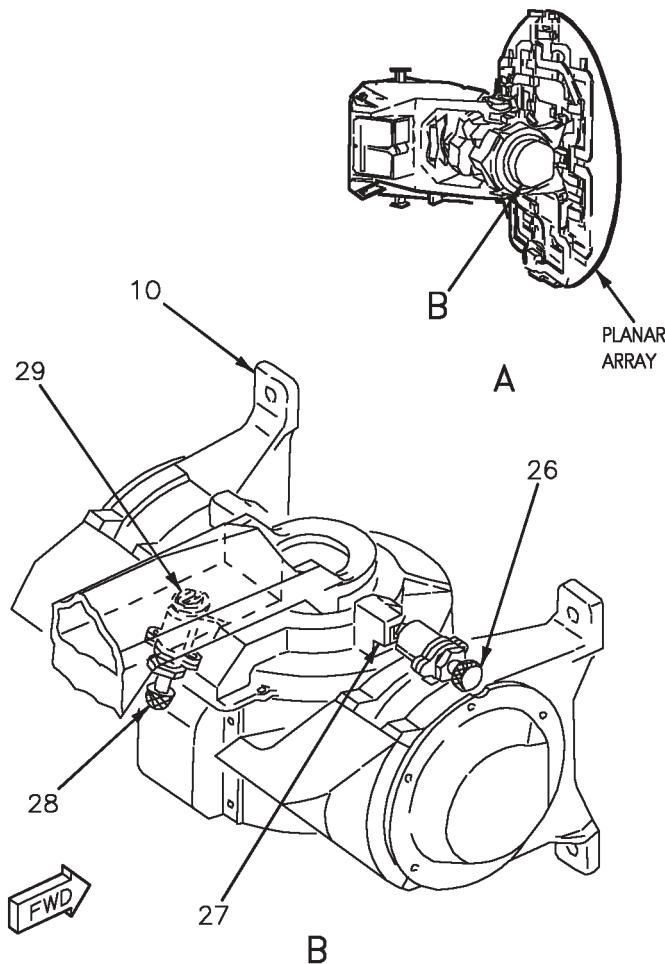
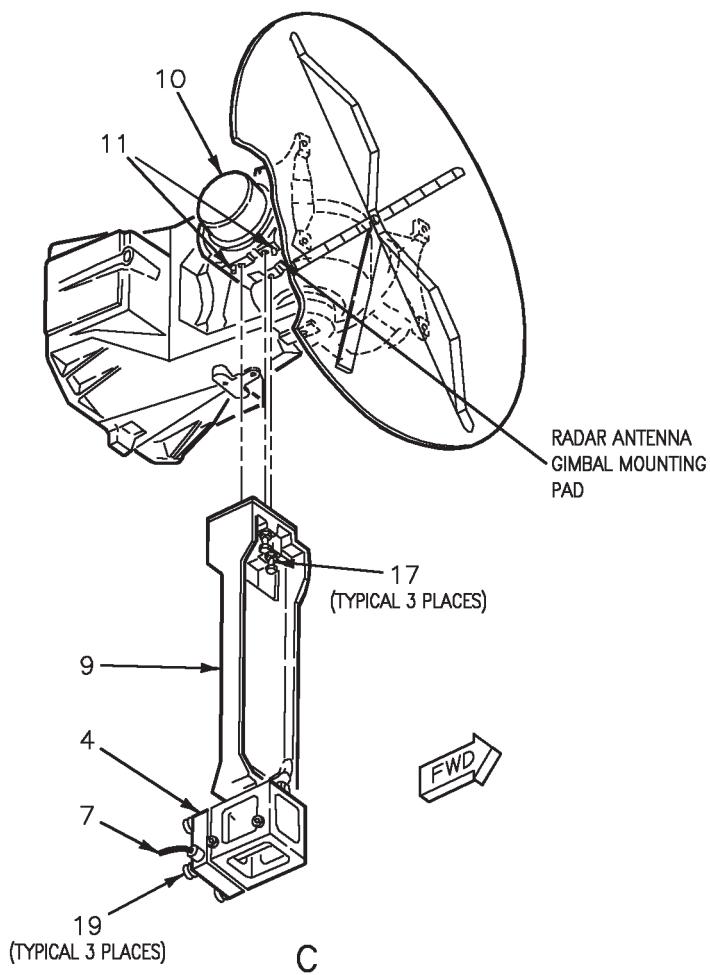


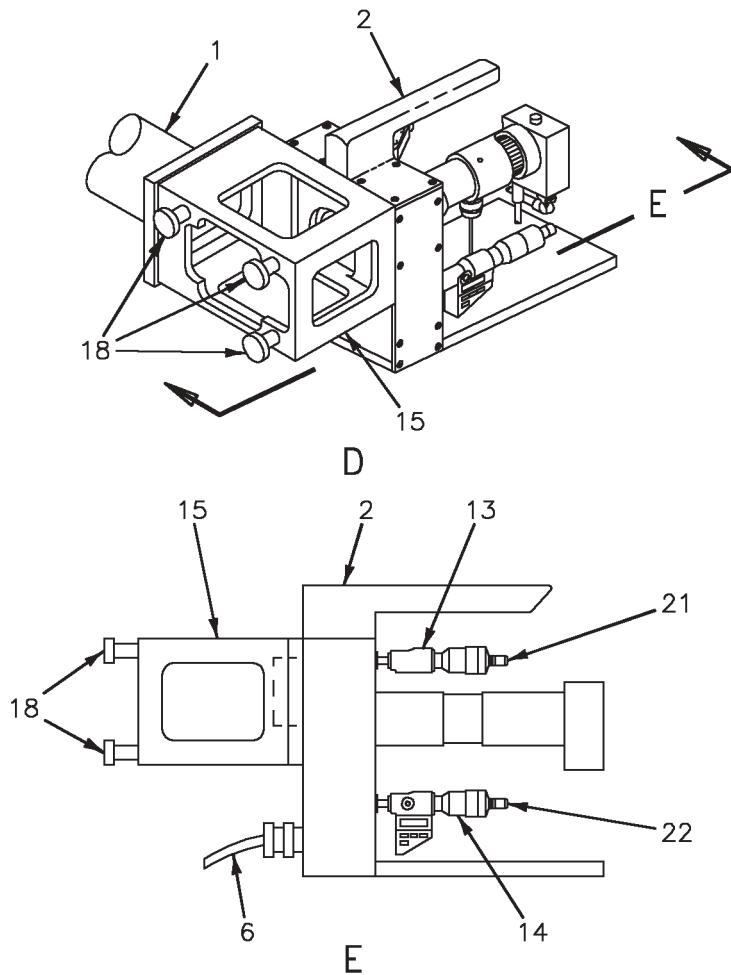
Figure 1. Radar Antenna (Sheet 2)

18AC-LMM-04-(16-2)11-SCAN



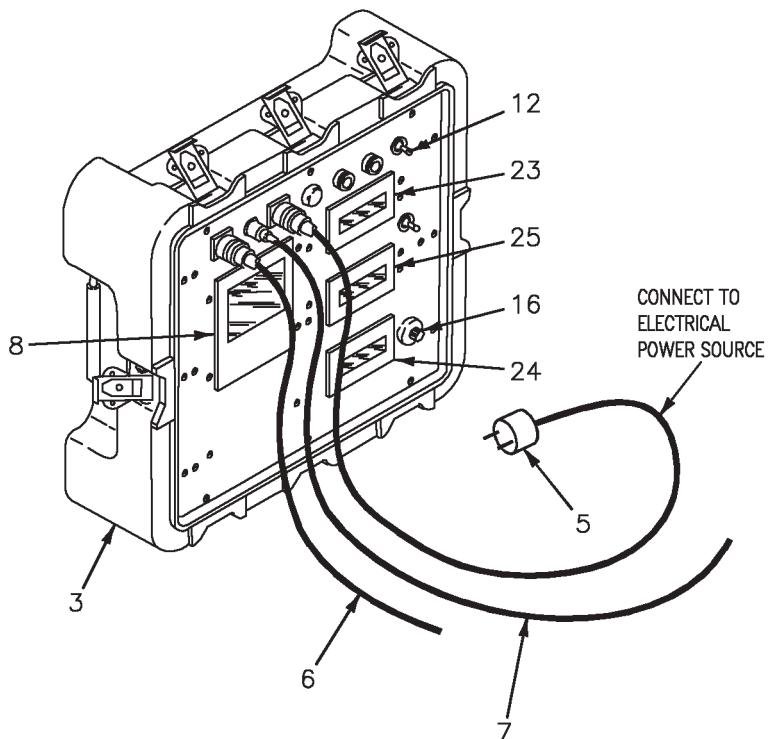
18AC-LMM-04-(16-3)11-SCAN

Figure 1. Radar Antenna (Sheet 3)



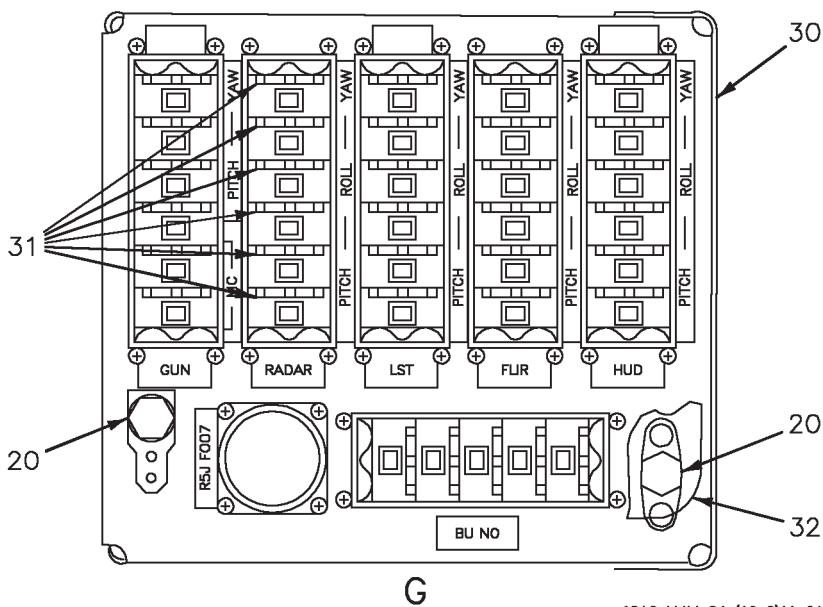
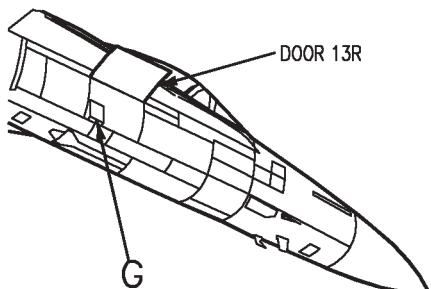
18AC-LMM-04-(16-4)11-SCAN

Figure 1. Radar Antenna (Sheet 4)

**F**

18AC-LMM-04-(16-5)11-SCAN

Figure 1. Radar Antenna (Sheet 5)



18AC-LMM-04-(16-6)11-CATI

Figure 1. Radar Antenna (Sheet 6)

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1] ◀	Boresight Reference Frame Assembly	74D111115
2 [2] ◀	Optical Reference Measurement Unit	537227
3 [2] ◀	Optical Target Monitor	437228
4 [2] ◀	Target Mirror Assembly	437232
5 [2] ◀	Power Cable	437230-1
6 [2] ◀	Cable	437230-2
7 [2] ◀	Cable	437230-3
8	Video Display	—
9 [1] ◀	Radar Antenna Alignment Adaptor	74D111084
10	Antenna Gimbal	—
11	Alignment Pin	—
12	Power Switch	—
13	Micrometer, Pitch	—
14	Micrometer, Yaw	—
15	Radar Alignment Box	—
16	Roll-Adjust Zero Potentiometer	—
17	Attach Bolt	—
18	Attach Bolt	—
19	Attach Bolt	—
20	Attach Bolt	—
21	Micrometer Spindle, Pitch	—
22	Micrometer Spindle, Yaw	—
23	Digital Display, Pitch	—
24	Digital Display, Roll	—
25	Digital Display, Yaw	—
26	Elevation Boresight Pin	—

Figure 1. Radar Antenna (Sheet 7)

INDEX NO.	NOMENCLATURE	PART NUMBER
27	Elevation Boresight Lock	—
28	Azimuth Boresight Pin	—
29	Azimuth Boresight Lock	—
30	Electrical Boresight Compensation Assy.	74A870612
31	RADAR Thumbwheel Switch	—
32	Guard	74A880682

LEGEND

[1] Part of 74D110163 boresight alignment set.
[2] Part of 537226 optical alignment set.

Figure 1. Radar Antenna (Sheet 8)

A1-F18AC-LMM-040

1 June 1993

006 00

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ORGANIZATIONAL MAINTENANCE

LINE MAINTENANCE BORESIGHTING DATA

20MM GUN SYSTEM

Title	WP Number
20MM Gun System	
Using 74D110021 Triaxial Alignment Set	006 01
Using 537226 Optical Alignment Set	006 02

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****20MM GUN SYSTEM****USING 74D110021 TRIAXIAL ALIGNMENT SET**

Reference Material

Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Airborne Weapons/Stores Loading.....	A1-F18AC-LWS-000
Guns	Section 28
Airborne Weapons/Stores Loading.....	A1-F18AE-LWS-000
Guns	Section 29
Communications, TACAN, ADF, Electronic	
Altimeter and IFF Systems	A1-F18AC-600-300
Receiver-Transmitter	
RT-1250/ARC-182(V) (76A-F002)	WP003 00
Weapon Control Systems	A1-F18AC-740-200
Electrical Boresight Compensation	
System Test.....	WP040 00
Weapon Control Systems	A1-F18AE-740-200
Electrical Boresight Compensation	
System Test.....	WP181 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	3
Aircraft Preparation.....	4
Alignment Verification/Alignment Procedure.....	4
Introduction.....	2
General Instructions.....	2
Safety Precautions.....	3

Record of Applicable Technical Directives

None

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for boresighting the 20MM gun system located in the forward fuselage.
3. **GENERAL INSTRUCTIONS.** To make sure the gun is accurately boresighted, the instructions below shall be used:
 - a. Due to equipment sensitivity, boresighting should only be done ashore.
 - b. Personnel must be familiar with the use and operation of the triaxial alignment set.
 - c. Personnel must know the principles of boresighting.
 - d. Boresighting should be done separately from other maintenance operations.

- d. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
- e. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.
- f. Attach bolts shall be clean and free of burrs and damaged threads.
- g. Visually inspect for loose or missing sealant around nuts on equipment.
- h. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

4. SAFETY PRECAUTIONS.

WARNING

Laser radiation, do not look into laser beams or eye injury could occur.

- a. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

5. AIRCRAFT BORESIGHT REQUIREMENTS.

- 6. Aircraft structural flexing affects boresight accuracy. To control the effect of this flexing and to be sure the boresight is accurate, make sure the aircraft is as listed below:

- a. Make sure all armament, avionics, electrical equipment and/or ballast is installed.

- b. Make sure gun system is unloaded (A1-F18AC-LWS-000, Section 28 or A1-F18AE-LWS-000, Section 29).
- c. Make sure door 3 is closed (A1-F18AC-LMM-010).

7. AIRCRAFT PREPARATION.

- a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

8. ALIGNMENT VERIFICATION/ALIGNMENT PROCEDURE.

See figure 1.

Support Equipment Required

Part Number or Type Designation	Nomenclature
11698215	Loader Handcrank
1245AS200-1	Drive Tool Extension
74D110163-1001	Boresight Alignment Set
74D110021-1003 (74D110021-1001)	Triaxial Alignment Set

Materials Required

Specification or Part Number	Nomenclature
CCC-C-440 TYPE 1, CLASS 1	Cheesecloth
P-D-680, TYPE 2	Dry Cleaning Solvent

- a. Verify alignment of triaxial alignment set (WP010 01).
- b. Set up and install boresight reference frame assembly (BRFA) (WP009 00).

NOTE

Three of the gun's six barrels are timed. The timed barrel sequence is one, three, and five.

Timed barrel boresight position is approximately 1:00 o'clock, with reference to pilot's eye position (11:00 o'clock position when viewing aft).

- c. Manually cycle the gun system (5) until one of the three timed barrels is locked in boresight position per substeps below:

NOTE

Access to gun handcrank socket is door 6L.

- (1) Insert loader handcrank (8) with drive tool extension (7) into gun handcrank socket (6).

NOTE

Access to gun timing pin is door 6L. Pin is on far side of gun system and not visible through door.

- (2) Press in and hold gun timing pin (9).



Rotate gun system in a clockwise direction only, or damage to gun system will occur.

- (3) Slowly rotate the gun system, by turning the loader handcrank (8), in a clockwise direction, until gun timing pin (9) can be fully pressed in, locking the gun in timed boresight position.

- d. Insert 74D111157 laser/mandrel (2), with line on laser plate aligned with line on clocking assembly (25), into timed barrel number 1.

NOTE

Failure to hook chain may degrade boresight accuracy.

- e. Hook chain (23) to BRFA (1).

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- f. Clean mating surfaces on 74D111167 triaxial detector unit (TDU) (3) and BRFA (1) using cheesecloth moistened with solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

- g. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- h. Make sure attach bolts are clean and free of burrs and damaged threads.
- i. Lift TDU (3) by its carrying handle, hold against BRFA (1) at gun target point.
- j. Engage and snug two upper attach bolts first, then the lower attach bolt.
- k. Hand tighten all three attach bolts (10) the same amount.

1. Connect 74D111162 cable (11) to laser/mandrel (2) and to control/display unit (4).
 - m. Connect 74D111145-1001 cable (12) to TDU (3) and to control/display unit (4).

NOTE

Failure to hook chain may degrade boresight accuracy.

- n. Hook chain (24) to BRFA (1).

WARNING

Laser radiation, do not look into laser beam or eye injury could occur.

NOTE

The gun laser light will illuminate when control/display unit (4) is turned on. When laser energy is not sensed by the TDU after approximately 15 seconds, it will inhibit the laser, causing the gun laser light to go off.

- o. Press control/ display unit switch (16) to ON position.

NOTE

The timed barrel pitch and yaw indications are displayed on the control/display unit (4). The PITCH and YAW displays are graduated in 0.01 milliradian increments. Because of equipment sensitivity, five indications should be taken, then use the average of these indications for alignment correction.

- p. Read and record plus-minus PITCH (13) and YAW (14) displays for timed barrel number 1.
- q. Push control/display unit (4) switch (16) to off position.
- r. Disconnect cable (11) from laser/mandrel (2).
- s. Disconnect cable (12) from TDU (3).
- t. Remove TDU (3) from BRFA (1) by removing three attach bolts (10).
- u. Unhook chain (23) from BRFA (1).
- v. Remove laser/mandrel (2) from timed barrel number 1.
- w. Manually cycle gun system until next timed barrel is in boresight position per substeps below:
 - (1) Press in and hold gun timing pin (9).
 - (2) Slowly rotate gun system by turning loader handcrank (8), in a clockwise direction, until gun timing pin (9) can be fully pressed in, locking the next timed barrel in boresight position.

- x. Insert laser/mandrel (2), with line on laser plate aligned with line on clocking assembly (25), into timed barrel number 2.
- y. Hook chain (23) to BRFA (1).
- z. Install TDU (3) on BRFA (1) with attach bolts (10) handtight.
 - aa. Connect cable (12) to TDU (3).
 - ab. Connect cable (11) to laser/mandrel (2).
 - ac. Press control/ display unit switch (16) to ON position.
 - ad. Read and record plus-minus PITCH (13) and YAW (14) displays for barrel number 2.
 - ae. Push control/display unit (4) switch (16) to off position.
 - af. Disconnect cable (11) from laser/mandrel (2).
 - ag. Disconnect cable (12) from TDU (3).
 - ah. Remove TDU (3) from BRFA (1) by removing three attach bolts (10).
 - ai. Unhook chain (23) from BRFA (1).
 - aj. Remove laser/mandrel (2) from timed barrel number 2.
 - ak. Manually cycle gun system until next timed barrel is in boresight position per substeps below:
 - (1) Press in and hold gun timing pin (9).

(2) Slowly rotate gun system by turning loader handcrank (8) in a clockwise direction until gun timing pin (9) can be fully pressed in, locking the next timed barrel in boresight position.

al. Insert laser/mandrel (2), with line on laser plate aligned with line on clocking assembly (25), into timed barrel number 3.

am. Hook chain (23) to BRFA (1).

an. Install TDU (3) on BRFA (1) with attach bolts (10) handtight.

ao. Connect cable (12) to TDU (3).

ap. Connect cable (11) to laser/mandrel (2).

aq. Press control/ display unit switch (16) to ON position.

ar. Read and record plus-minus PITCH (13) and YAW (14) displays for barrel number 3.

as. Push control/display unit (4) switch (16) to off position.

at. Unplug cable (22) from electrical power source if external power was used.

au. Disconnect cable (21), and ground wire, from control/display unit (4) and cable (22).

av. Unhook chain (24) from BRFA (1).

aw. Disconnect cable (12) from TDU (3) and control/display unit (4).

ax. Disconnect cable (11) from laser/mandrel (2) and control/display unit (4).

ay. Remove TDU (3) from BRFA (1) by removing three attach bolts (10).

az. Unhook chain (23) from BRFA (1).

ba. Remove laser/mandrel (2) from timed barrel number 3.

bb. Remove loader handcrank (8) and drive tool extension (7) from gun handcrank socket (6).

bc. Determine the average boresight value of the three timed barrels per substeps below:

(1) Add the plus-minus PITCH values for timed barrels 1, 2, and 3.

(2) Divide the sum by 3.

(3) Record the new average boresight PITCH value to the nearest plus-minus 0.5 milliradian.

(4) Add the plus-minus YAW values for timed barrels 1, 2, and 3.

(5) Divide the sum by 3.

(6) Record the new average boresight YAW value to the nearest plus-minus 0.5 milliradian.

bd. If the average boresight value is between -7.5 and +7.5 milliradians, go to next step. If not, a depot engineering disposition is required.

be. Open door 13R (A1-F18AC-LMM-010).

bf. Remove aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

NOTE

The electrical boresight compensation assembly has a plus-minus thumbwheel switch and a milliradian thumbwheel switch for the GUN PITCH and YAW settings.

bg. Read and record the electrical boresight compensation assembly (17) GUN PITCH and YAW plus-minus milliradian thumbwheel switch (20) settings.

bh. If GUN PITCH and YAW thumbwheel switches (20) are the same as the new gun average boresight value, go to step bo. If not the same, go to next step.

NOTE

Do not turn the electrical boresight compensation assembly GUN-MC or other system thumbwheel switches, as it will cause the affected system to have the wrong boresight compensation data.

bi. Remove guard (18) by removing attach bolts (19).

NOTE

Ignore any existing data on GUN thumbwheel switches. Adjust PITCH and YAW thumbwheel switches until the applicable plus or minus sign and milliradian number are displayed. The milliradian thumbwheel switches are graduated in 0.5 milliradian increments with a range from 0.0 to 7.5 milliradians.

bj. Input average boresight point to the nearest 0.5 milliradian into electrical boresight compensation assembly (17) GUN, PITCH and YAW thumbwheel switches (20).

bk. Record new thumbwheel switch (20) settings on Miscellaneous History Card OPNAV 4790/25A, part of the Aircraft Log Book.

NOTE

Setting GUN-MC thumbwheel switch is a factory adjustment and should not be changed.

bl. Verify GUN-MC thumbwheel switch on electrical boresight compensation assembly (17) is set on +2.0 for 161353 THRU 161987 or +2.5 for 162394 AND UP.

bm. Do electrical boresight compensation system test (A1-F18AC-740-200, WP040 00 or A1-F18AE-740-200, WP181 00).

bn. Install guard (18) on electrical boresight compensation assembly (17) using attach bolts (19).

bo. Install aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

- bp. Inspect door 13R area for foreign objects.
- bq. Close door 13R (A1-F18AC-LMM-010).
- br. Inspect door 6L area for foreign objects.
- bs. Close door 6L (A1-F18AC-LMM-010).
- bt. If all boresighting is completed, remove and stow BRFA (WP009 00).
 - bu. If all boresighting is completed, remove safety devices, as required (A1-F18AC-PCM-000).

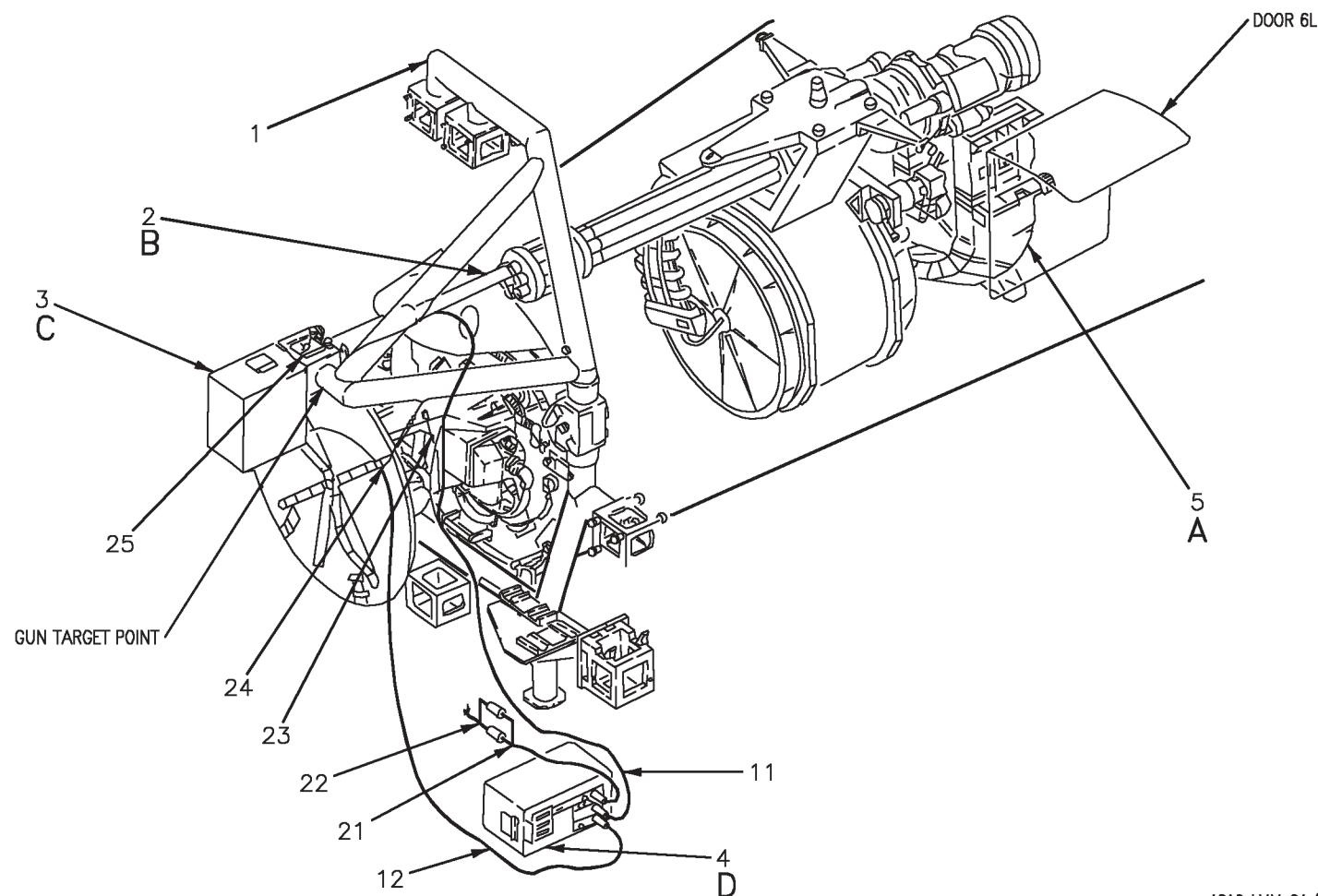


Figure 1. 20MM Gun System (Sheet 1)

Figure 1.

18AC-LMM-04-(11-1)11-SCAN

Figure 1.

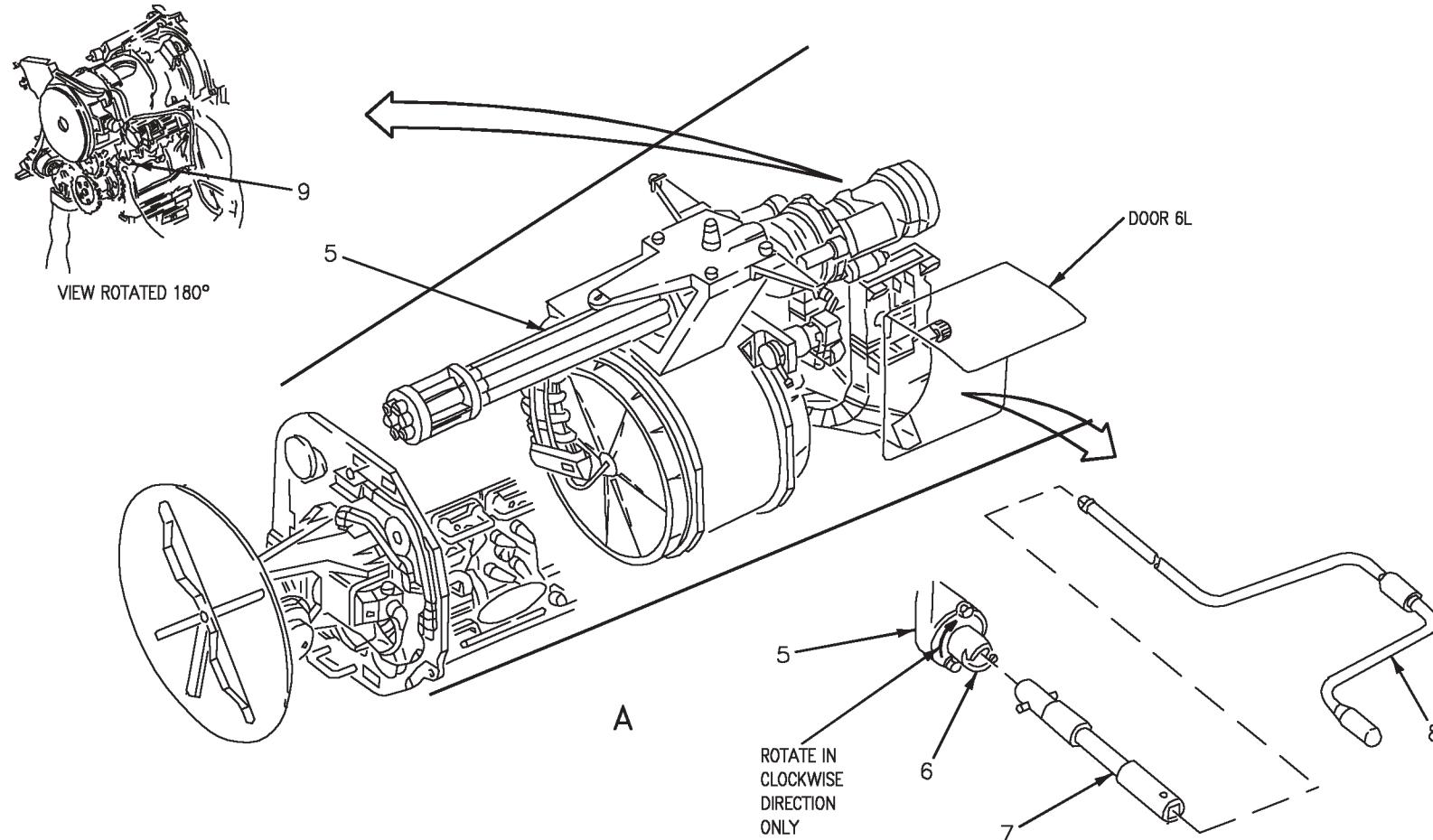
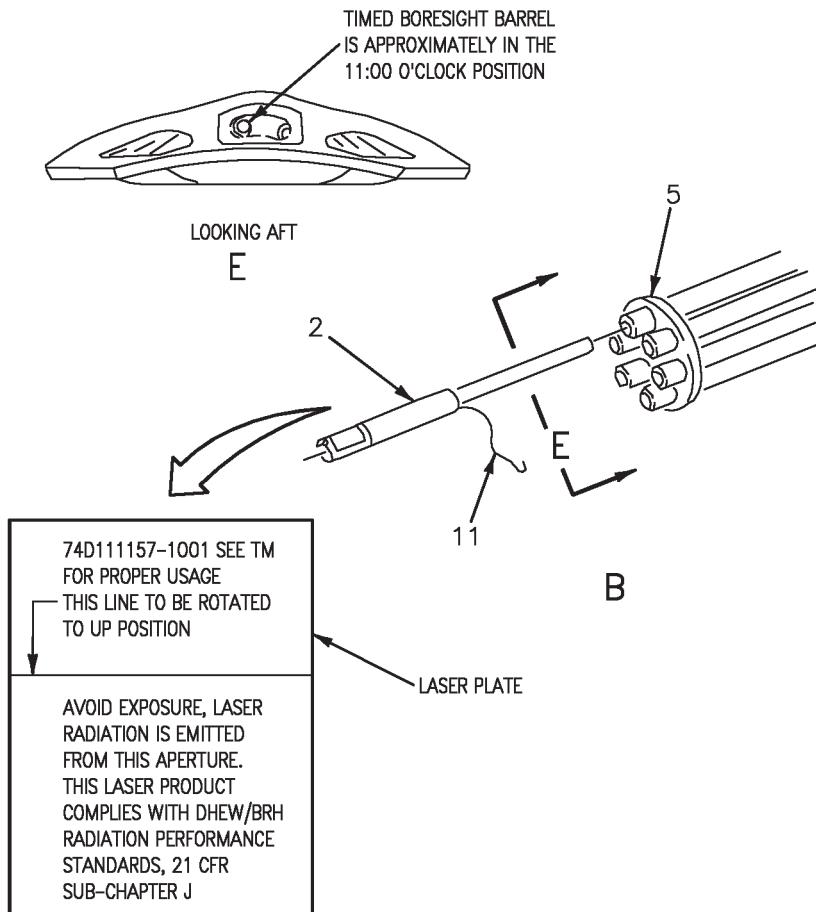


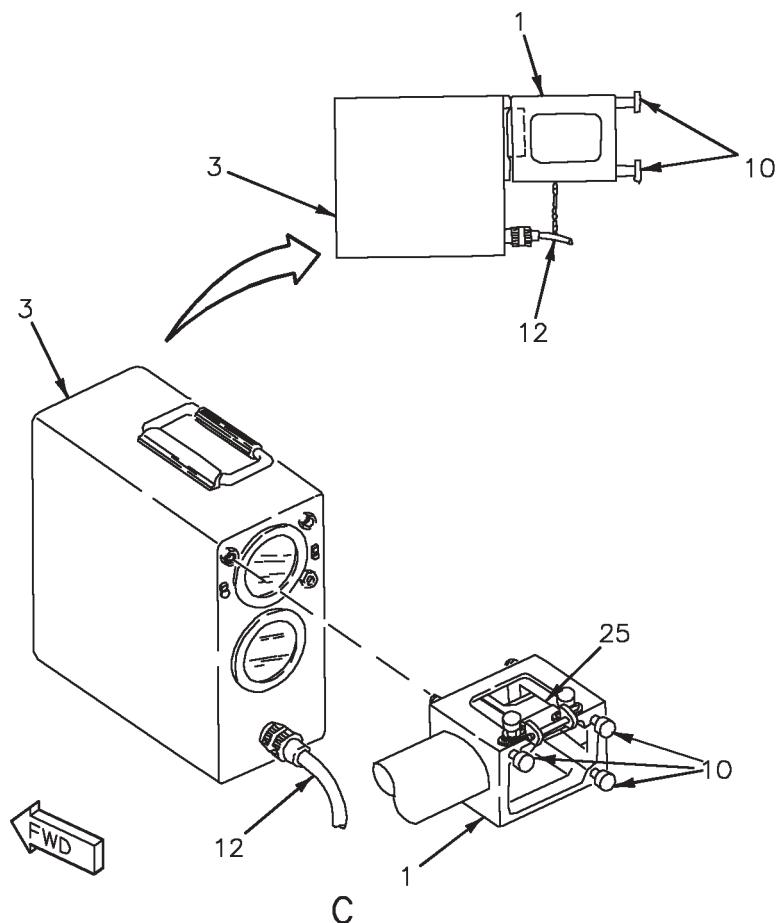
Figure 1. 20MM Gun System (Sheet 2)

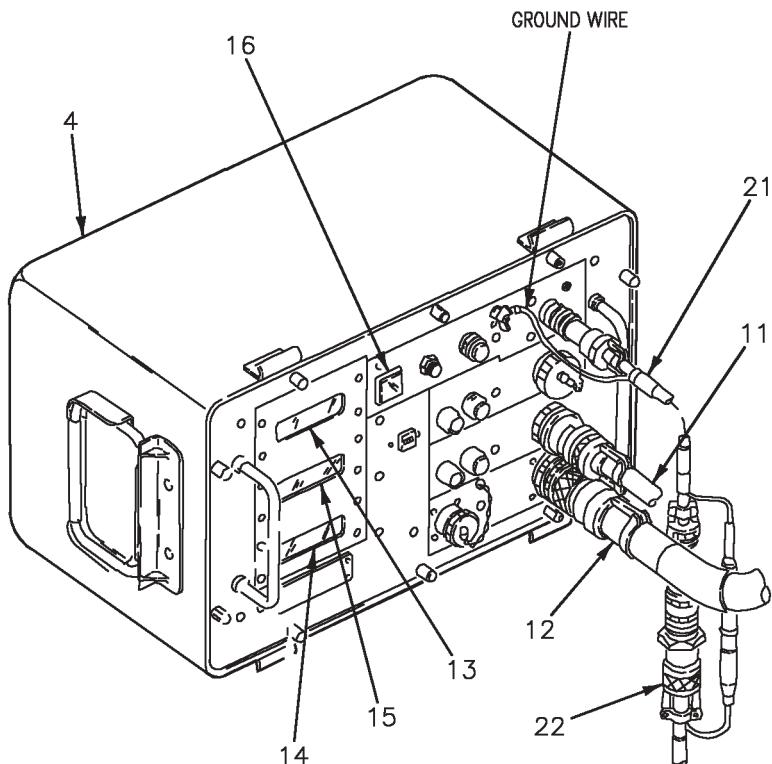
Figure 1.

Figure 1.

18AC-LMM-04-(11-2)11-CATI



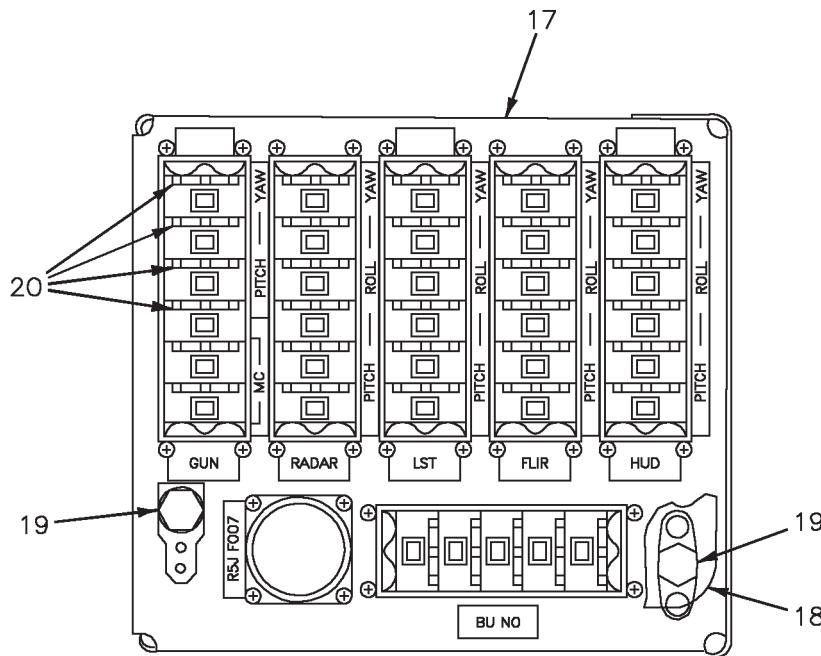
**Figure 1. 20MM Gun System (Sheet 4)**



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18AC-LMM-04-(11-5)11-SCAN

Figure 1. 20MM Gun System (Sheet 5)



INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]▶	Boresight Reference Frame Assembly	74D111115
2 [2]▶	Laser/Mandrel	74D111157
3 [2]▶	Triaxial Detector Unit - TDU	74D111167
4 [2]▶	Control/Display Unit	74D111141
5	20MM Gun System	—
6	Gun Handcrank Socket	—
7	Drive Tool Extension	1245AS200-1
8	Loader Handcrank	11698215
9	Gun Timing Pin	—
10	Attach Bolt	—
11 [2]▶	Cable	74D111162
12 [2]▶	Cable	74D111145-1001
13	Pitch Display	—
14	Yaw Display	—
15	Roll Display	—
16	Switch	—
17	Electrical Boresight Compensation Assy.	74A870612
18	Guard	74A880682
19	Attach Bolt	—
20	Thumbwheel Switch	—
21 [2]▶	Cable	74D111145-1003
22 [2]▶	Cable	74D111145-1005
23	Chain	—
24	Chain	—
25	Clocking Assembly	—

Figure 1. 20MM Gun System (Sheet 7)

A1-F18AC-LMM-040

006 01

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INDEX NO.	NOMENCLATURE	PART NUMBER
LEGEND		
 1	Part of 74D110163 boresight alignment set.	
 2	Part of 74D110021 triaxial alignment set.	

Figure 1. 20MM Gun System (Sheet 8)

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****20MM GUN SYSTEM****USING 537226 OPTICAL ALIGNMENT SET**

Reference Material

Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Airborne Weapons/Stores Loading.....	A1-F18AC-LWS-000
Guns	Section 28
Airborne Weapons/Stores Loading.....	A1-F18AE-LWS-000
Guns	Section 29
Communications, TACAN, ADF, Electronic	
Altimeter and IFF Systems	A1-F18AC-600-300
Receiver-Transmitter	
RT-1250/ARC-182(V) (76A-F002)	WP003 00
Weapon Control Systems	A1-F18AC-740-200
Electrical Boresight Compensation	
System Test.....	WP040 00
Weapon Control Systems	A1-F18AE-740-200
Electrical Boresight Compensation	
System Test.....	WP181 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	3
Aircraft Preparation.....	4
Alignment Verification Procedure	4
Introduction.....	2
General Instructions.....	2
Safety Precautions.....	3

Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
SEC 4998	—	Replacement of 74D110021 Triaxial Alignment Set With 537226 Optical Alignment Set. (Alameda ECP 775)	1 Jun 93	—

- 1. INTRODUCTION.**
- This work package contains organizational level maintenance instructions for boresighting the 20MM gun system located in the forward fuselage.
- 3. GENERAL INSTRUCTIONS.** To make sure the gun is accurately boresighted, the instructions below shall be used:

- a. Due to equipment sensitivity, boresighting should only be done ashore.
- b. Personnel must be familiar with the use and operation of the optical alignment set.
- c. Personnel must know the principles of boresighting.
- d. Boresighting should be done separately from other maintenance operations.
- e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
- f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.
- g. Attach bolts shall be clean and free of burrs and damaged threads.
- h. Visually inspect for loose or missing sealant around nuts on equipment.
- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

4. SAFETY PRECAUTIONS.

- a. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

5. AIRCRAFT BORESIGHT REQUIREMENTS.

6. Aircraft structural flexing affects boresight accuracy. To control the effect of this flexing and to be sure the boresight is accurate, make sure the aircraft is as listed below:

- a. Make sure all armament, avionics, electrical equipment and/or ballast is installed.
- b. Make sure gun system is unloaded (A1-F18AC-LWS-000, Section 28 or A1-F18AE-LWS-000, Section 29).
- c. Make sure door 3 is closed (A1-F18AC-LMM-010).

7. AIRCRAFT PREPARATION.

- a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

8. ALIGNMENT VERIFICATION PROCEDURE. See figure 1.**Support Equipment Required**

Part Number or Type Designation	Nomenclature
74D110163-1001	Boresight Alignment Set
537226	Optical Alignment Set
11698215	Loader Handcrank
1245AS200-1	Drive Tool Extension

Materials Required

Specification or Part Number	Nomenclature
---	---------------------

CCC-C-440 TYPE 1, CLASS 1	Cheesecloth
P-D-680, TYPE 2 M83953-1 or -2	Dry Cleaning Solvent Pencil, Aircraft Marking (-1 Yellow) (-2 Red)

- a. Verify alignment of optical alignment set (WP010 02).
- b. Set up and install boresight reference frame assembly (BRFA) (1) (WP009 00).

NOTE

Three of the gun's six barrels are timed. The timed barrel sequence is one, three, and five.

Timed barrel boresight position is approximately 1:00 o'clock, with reference to pilot's eye position (11:00 o'clock position when viewing aft).

- c. Manually cycle the gun system (9) until one of the three timed barrels is locked in boresight position per substeps below:
 - (1) Open door 6L to access gun handcrank socket (A1-F18AC-LMM-010).

(2) Insert loader handcrank (10) with drive tool extension (11) into gun handcrank socket (7).

NOTE

Access to gun timing pin is door 6L. Pin is on far side of gun system and not visible through door.

(3) Press in and hold gun timing pin (17).



Rotate gun system in a clockwise direction only, or damage to gun system will occur.

(4) Slowly rotate gun system by turning loader handcrank (10) in a clockwise direction. Rotate until gun timing pin (17) can be fully pressed in, locking gun in timed boresight position. Mark this timed barrel as number 1.

d. Insert mirror/mandrel assembly (16) into timed barrel number 1 until fully seated.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- e. Clean attach points on optical reference measurement unit (2) and gun alignment box (15) using clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

- f. Visually inspect attach points to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- g. Make sure attach bolts are clean and free of burrs and damaged threads.
- h. Lift optical reference measurement unit (2) by its carrying handle, hold against gun alignment box (15) attach points.
- i. Engage and snug two upper attach bolts first, then the lower attach bolt.
- j. Hand tighten all three attach bolts (4) the same amount.

- k. Position optical target monitor (3) close to optical reference measurement unit (2) so video display (8) may be viewed while adjusting pitch and yaw micrometers (13) and (14).
- l. Connect cable (6) to optical target monitor (3) and optical reference measurement unit (2).
- m. Connect power cable (5) to optical target monitor (3).
- n. Plug power cable (5) to electrical power source.
- o. Switch optical target monitor power switch (12) to ON.

NOTE

Do not adjust roll setting potentiometer (22).

- p. View video display (8) for crosshair position on target rings. If required, adjust pitch and yaw micrometers (13) and (14) by rotating pitch and yaw micrometer spindles (18) and (19) to get centering of crosshairs on target rings.
- q. Read and record plus-minus PITCH (20) and YAW (21) display indications from optical target monitor (3). Record indications for timed barrel number 1.
- r. Switch optical target monitor power switch (12) to OFF.
- s. Remove mirror/mandrel assembly (16) from timed barrel number 1.
- t. Manually cycle gun system until next timed barrel is in boresight position per substeps below:

(1) Press in and hold gun timing pin (17).

(2) Slowly rotate gun system by turning loader handcrank (10) in a clockwise direction. Rotate until gun timing pin (17) can be fully pressed in, locking gun in the next timed boresight position. Mark this timed barrel as number 2.

u. Insert mirror/mandrel assembly (16) into timed barrel number 2 until fully seated.

v. Switch optical target monitor power switch (12) to ON.

NOTE

Do not adjust roll setting potentiometer (22).

w. View video display (8) for crosshair position on target rings. If required, adjust pitch and yaw micrometers (13) and (14) by rotating pitch and yaw micrometer spindles (18) and (19) to get centering of crosshairs on target rings.

x. Read and record plus-minus PITCH (20) and YAW (21) display indications from optical target monitor (3). Record indications for timed barrel number 2.

y. Switch optical target monitor power switch (12) to OFF.

z. Remove mirror/mandrel assembly (16) from timed barrel number 2.

aa. Manually cycle gun system until next timed barrel is in boresight position per substeps below:

(1) Press in and hold gun timing pin (17).

(2) Slowly rotate gun system by turning loader handcrank (10) in a clockwise direction. Rotate until gun timing pin (17) can be fully pressed in, locking gun in the next timed boresight position. Mark this timed barrel as number 3.

ab. Insert mirror/mandrel assembly (16) into timed barrel number 3 until fully seated.

ac. Switch optical target monitor power switch (12) to ON.

NOTE

Do not adjust roll setting potentiometer (22).

ad. View video display (8) for crosshair position on target rings. If required, adjust pitch and yaw micrometers (13) and (14) by rotating pitch and yaw micrometer spindles (18) and (19) to get centering of crosshairs on target rings.

ae. Read and record plus-minus PITCH (20) and YAW (21) display indications from optical target monitor (3). Record indications for timed barrel number 3.

af. Switch optical target monitor power switch (12) to OFF.

ag. Unplug power cable (5) from electrical power source.

ah. Disconnect power cable (5) from optical target monitor (3).

ai. Disconnect cable (6) from optical target monitor (3) and optical reference measurement unit (2).

aj. Remove optical reference measurement unit (2) from gun alignment box (15).

3. ak. Remove mirror/mandrel assembly (16) from timed barrel number 3.

al. Remove loader handcrank (10) and drive tool extension (11) from gun handcrank socket (7).

am. Replace all boresighting equipment to proper storage areas.

an. Determine the average boresight value of the three timed barrels per substeps below:

(1) Add the plus-minus PITCH values for timed barrels 1, 2, and 3.

(2) Divide the sum by 3.

(3) Record the new average boresight PITCH value to the nearest plus-minus 0.5 milliradian.

(4) Add the plus-minus YAW values for timed barrels 1, 2, and 3.

(5) Divide the sum by 3.

(6) Record the new average boresight YAW value to the nearest plus-minus 0.5 milliradian.

ao. If the average boresight value is between -7.5 and +7.5 milliradians, go to next step. If not, a depot engineering disposition is required.

ap. Open door 13R (A1-F18AC-LMM-010).

aq. Remove aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

NOTE

The electrical boresight compensation assembly has a plus-minus thumbwheel switch and a milliradian thumbwheel switch for the GUN PITCH and YAW settings.

ar. Read and record the electrical boresight compensation assembly (23) GUN PITCH and YAW plus-minus milliradian thumbwheel switch (24) settings.

as. If GUN PITCH and YAW thumbwheel switches (24) are the same as the new gun average boresight value, go to step az. If not the same, go to next step.

NOTE

Do not turn the electrical boresight compensation assembly GUN-MC or other system thumbwheel switches, as it will cause the affected system to have the wrong boresight compensation data.

at. Remove guard (25) by removing attach bolts (26).

NOTE

Ignore any existing data on GUN thumbwheel switches. Adjust PITCH and YAW thumbwheel switches until the applicable plus or minus sign and milliradian number are displayed. The milliradian thumbwheel switches are graduated in 0.5 milliradian increments with a range from 0.0 to 7.5 milliradians.

au. Input average boresight point to the nearest 0.5 milliradian into electrical boresight compensation assembly (23) GUN, PITCH and YAW thumbwheel switches (24).

av. Record new thumbwheel switch (24) settings on Miscellaneous History Card OPNAV 4790/25A, part of the Aircraft Log Book.

NOTE

Setting GUN-MC thumbwheel switch is a factory adjustment and should not be changed.

aw. Verify GUN-MC thumbwheel switch on electrical boresight compensation assembly (23) is set on +2.0 for 161353 THRU 161987 or +2.5 for 162394 AND UP.

ax. Do electrical boresight compensation system test (A1-F18AC-740-200, WP040 00 or A1-F18AE-740-200, WP181 00).

ay. Install guard (25) on electrical boresight compensation assembly (23) using attach bolts (26).

az. Install aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

- ba. Inspect door 13R area for foreign objects.
- bb. Close door 13R (A1-F18AC-LMM-010).
- bc. Inspect door 6L area for foreign objects.
- bd. Close door 6L (A1-F18AC-LMM-010).
- be. If all boresighting is completed, remove and stow BRFA (1) (WP009 00).
- bf. If all boresighting is completed, remove safety devices, as required (A1-F18AC-PCM-000).

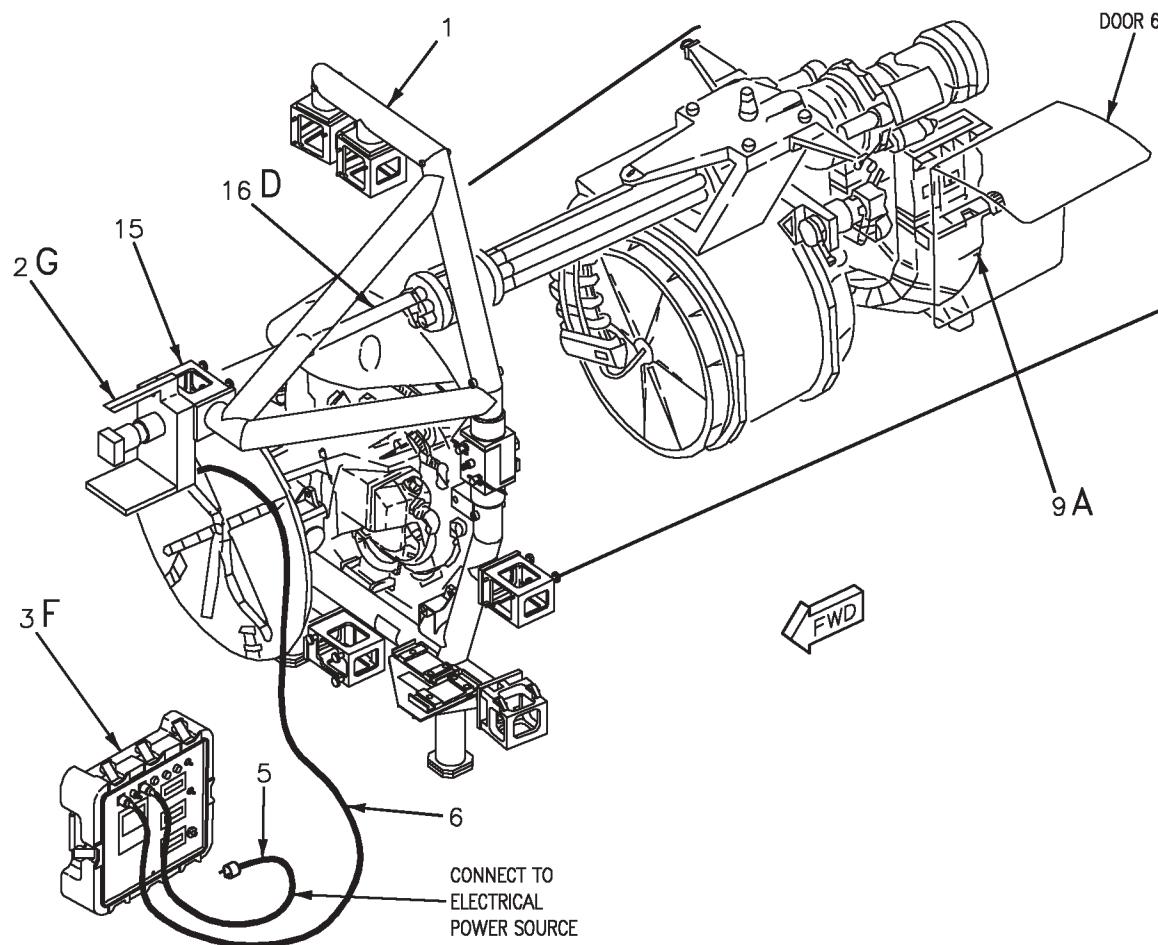


Figure 1. 20MM Gun System (Sheet 1)

Figure 1.

Figure 1.

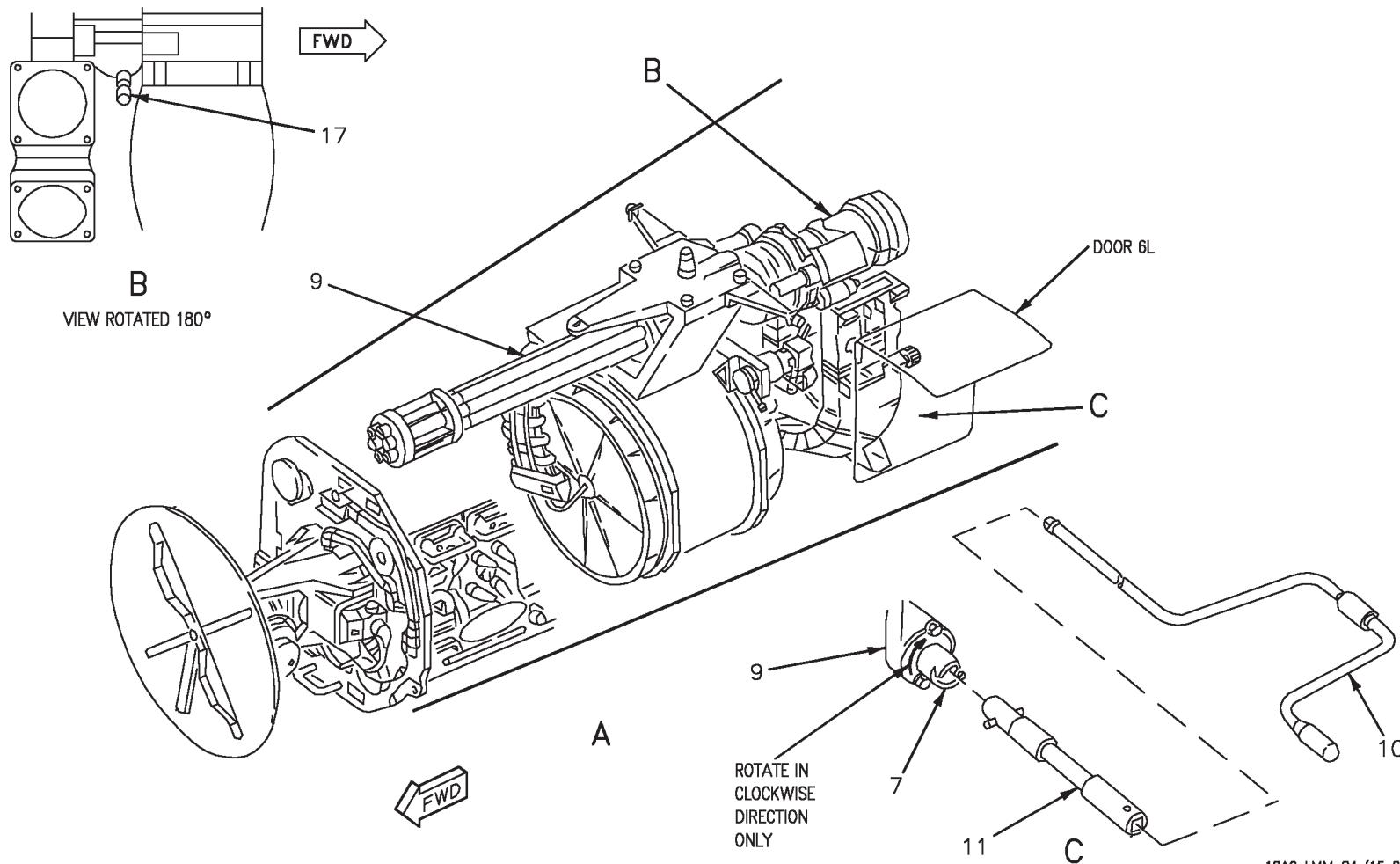
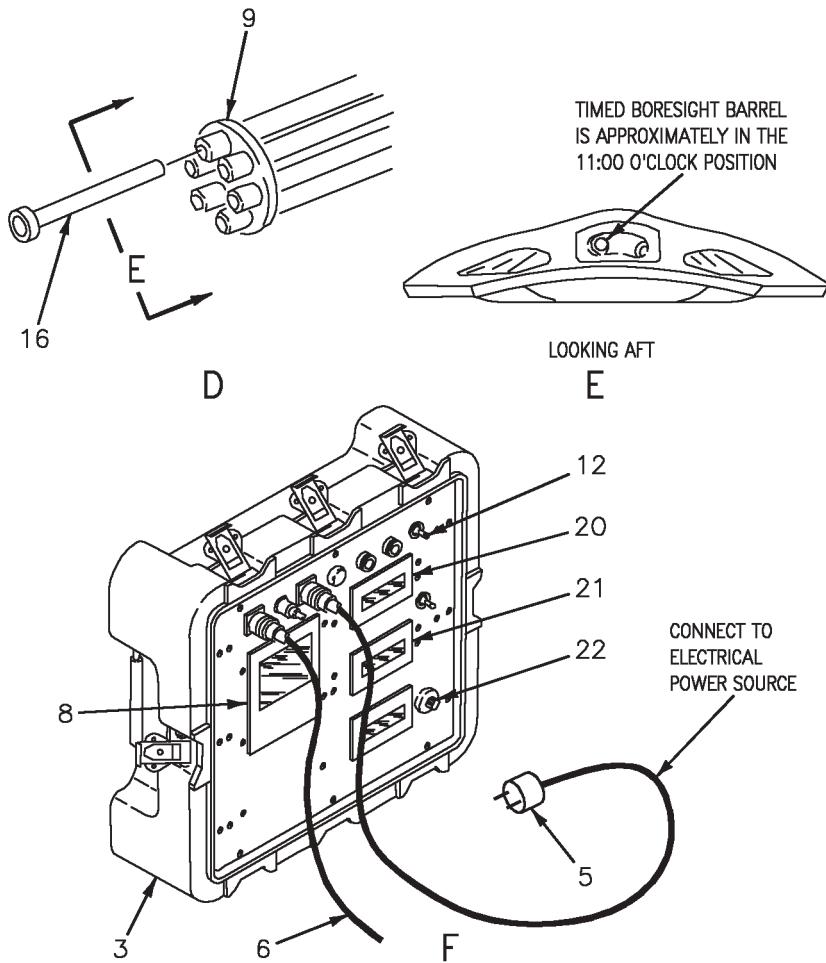


Figure 1. 20MM Gun System (Sheet 2)

18AC-LMM-04-(15-2)11-SCAN

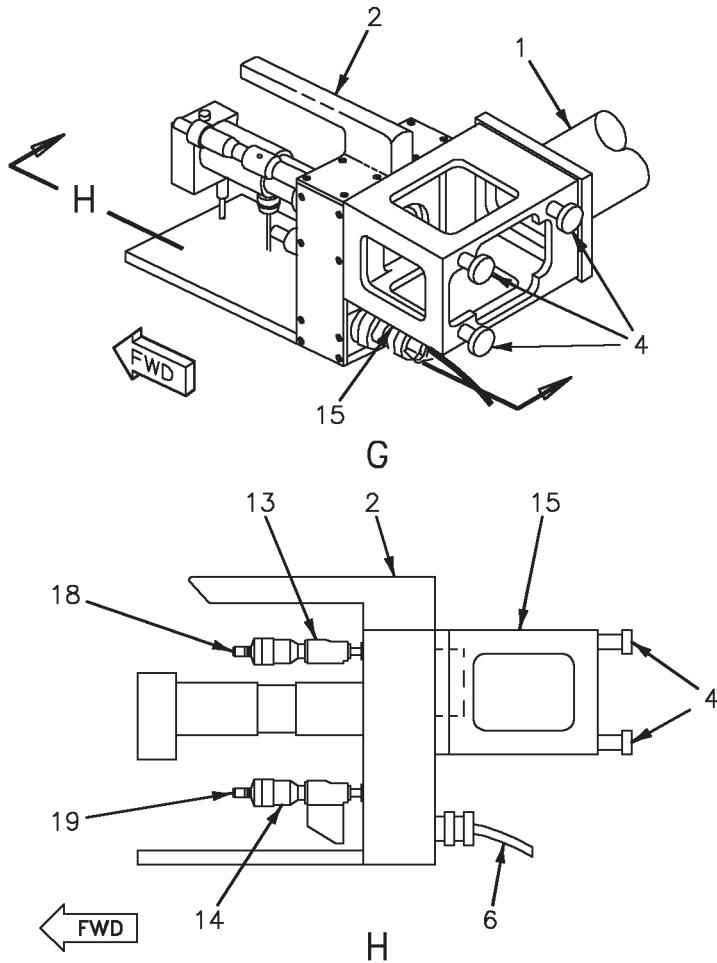
Figure 1.

Figure 1.



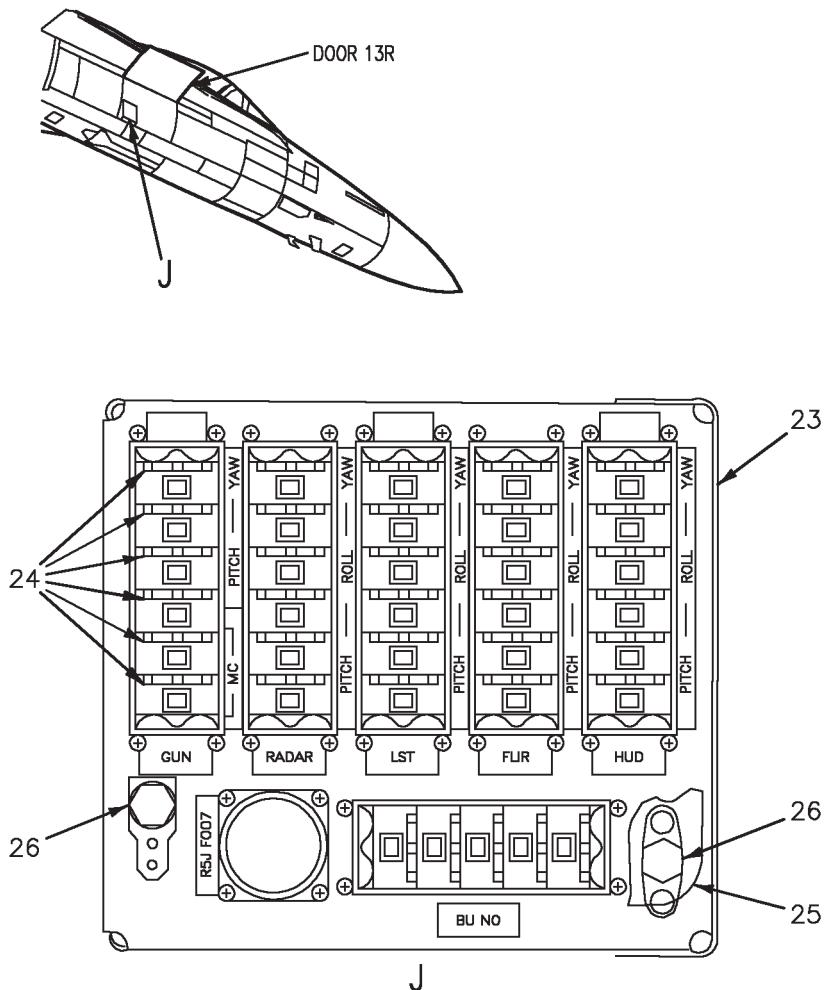
18AC-LMM-04-(15-3)11-SCAN

Figure 1. 20MM Gun System (Sheet 3)



18AC-LMM-04-(15-4)11-SCAN

Figure 1. 20MM Gun System (Sheet 4)



18AC-LMM-04-(15-5)11-CATI

Figure 1. 20MM Gun System (Sheet 5)

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]◆	Boresight Reference Frame Assembly	74D111115
2 [2]◆	Optical Reference Measurement Unit	537227
3 [2]◆	Optical Target Monitor	437228
4	Attach Bolts	—
5 [2]◆	Power Cable	437230-1
6 [2]◆	Cable	437230-2
7	Gun Handcrank Socket	—
8	Video Display	—
9	20MM Gun System	—
10	Loader Handcrank	11698215
11	Drive Tool Extension	1245AS200-1
12	Power Switch	—
13	Micrometer, Pitch	—
14	Micrometer, Yaw	—
15	Gun Alignment Box	—
16	Mirror/Mandril Assembly	—
17	Gun Timing Pin	—
18	Micrometer Spindle, Pitch	—
19	Micrometer Spindle, Yaw	—
20	Digital Display, Pitch	—
21	Digital Display, Yaw	—
22	Roll-Adjust Zero Potentiometer	—
23	Electrical Boresight Compensation Assy.	74A870612
24	Gun Thumbwheel Switch	—
25	Guard	74A880682
26	Attach Bolt	—

Figure 1. 20MM Gun System (Sheet 6)

A1-F18AC-LMM-040

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INDEX NO.	NOMENCLATURE	PART NUMBER
LEGEND		
 1	Part of 74D110163 boresight alignment set.	
 2	Part of 537226 optical alignment set.	

Figure 1. 20MM Gun System (Sheet 7)

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****FORWARD LOOKING INFRARED SYSTEM MOUNT**

Title	WP Number
Forward Looking Infrared System Mount	
Using 74D110021 Triaxial Alignment Set	007 01
Using 537226 Optical Alignment Set	007 02

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****FORWARD LOOKING INFRARED SYSTEM MOUNT****USING 74D110021 TRIAXIAL ALIGNMENT SET**

Reference Material

Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Communication, TACAN, ADF, Electronic Al- timeter and IFF Systems.....	A1-F18AC-600-300
Receiver-Transmitter	
RT-1250/ARC-182(V) (76A-F002)	WP003 00
Forward Looking Infrared System.....	A1-F18AC-744-300
Detecting Set AN/AAS-38	WP003 00
Weapon Control Systems	A1-F18AC-740-200
Electrical Boresight Compensation System Test.....	WP040 00
Weapon Control Systems	A1-F18AE-740-200
Electrical Boresight Compensation System Test.....	WP181 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	4
Aircraft Preparation.....	5
Alignment Verification/Realignment Procedure.....	5
Introduction.....	2
General Instructions.....	2
Safety Precautions.....	3

Record of Applicable Technical Directives

None

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for boresighting the forward looking infrared system (FLIR) mount attach points. Misalignment is corrected using the electrical boresight compensation assembly.

3. **GENERAL INSTRUCTIONS.** To make sure the FLIR mount is accurately boresighted, the instructions below shall be used:

- a. Due to equipment sensitivity, boresighting should only be done ashore.
- b. Personnel must be familiar with the use and operation of the triaxial alignment set.
- c. Personnel must know the principles of boresighting.

- d. Boresighting should be done separately from other maintenance operations.
- e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
- f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.
- g. Attach bolts shall be clean and free of burrs and damaged threads.
- h. Visually inspect for loose or missing sealant around nuts on equipment.
- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

4. SAFETY PRECAUTIONS.

WARNING

Laser radiation, do not look into laser beams or eye injury could occur.

- a. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

5. AIRCRAFT BORESIGHT REQUIREMENTS.

6. Aircraft structural flexing affects FLIR boresight accuracy. To control the effect of this flexing and to be sure the mount boresight is accurate, make sure the aircraft is as listed below:

a. Forward fuselage:

- (1) Make sure all armament, avionics, electrical equipment, and/or ballast forward of the nose gear is installed.
- (2) Make sure ammunition drum is empty.
- (3) Make sure windshield is closed.
- (4) Make sure door 3 is closed (A1-F18AC-LMM-010).

b. Cockpit(s): Make sure no personnel, tools, and/or equipment are in cockpit.

c. Center and aft fuselage: Preferred configuration is engines installed and internal fuel cells full. However, two alternate configurations may be used: engines installed with aircraft defueled or engines removed with aircraft defueled. If alternate configuration is used, pitch compensation is required during boresighting.

d. External stores:

(1) Pylons, weapon launcher and/or ejector racks may be installed on all stations in any combination.

(2) Empty external fuel tanks and wing tip sidewinders may be installed.

(3) Laser detector-tracker-strike camera set may be installed.

7. AIRCRAFT PREPARATION.

a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

b. Remove Detecting Set AN/AAS-38 (A1-F18AC-744-300, WP003 00).

c. On 165171 AND UP, remove upper chaff dispenser fairing and lower chaff dispenser fairing (A1-F18AC-SRM-430, FIG008 00). █

8. ALIGNMENT VERIFICATION/REALIGNMENT PROCEDURE. See figure 1.

Support Equipment Required

Part Number or Type Designation	Nomenclature
74D110163-1001 (74D110153-1001)	Boresight Alignment Set (FLIR Mount Alignment Adapter)
74D110021-1003 (74D110021-1001)	Triaxial Alignment Set
—	Torque Wrench, 0 to 200 Inch-Pounds

Materials Required

Specification or Part Number	Nomenclature
CCC-C-440 TYPE 1, CLASS 1	Cheesecloth
P-D-680, TYPE 2	Dry Cleaning Solvent
<p>a. Verify alignment of triaxial alignment set (WP010 01).</p> <p>b. Set up and install boresight reference frame assembly (BRFA) (WP009 00).</p>	
WARNING	
<p>Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.</p>	
<p>c. Clean mating surfaces on 74D111159 beam splitter assembly (9) and BRFA (1) using cheesecloth moistened with solvent.</p>	

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

- d. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- e. Make sure attach bolts are clean and free of burrs and damaged threads.
- f. Hold beam splitter assembly (9) near the top of box frame against BRFA (1) at FLIR target point .
- g. Engage and snug two upper attach bolts first, then the lower attach bolt.
- h. Hand tighten all three attach bolts (13) the same amount.
- i. Install 74D111180 laser (11) on cone bolts in BRFA (1) at FLIR target point per substeps below:
 - (1) Wipe all oil and fingerprints from steel tube using clean cheesecloth.
 - (2) Open two laser clamps (12).
 - (3) Slide laser (11) aft into BRFA (1) and beam splitter assembly (9) until line on laser plate is aligned with forward edge of BRFA.
 - (4) Rotate laser to align line on laser plate with up mark on BRFA (1).

(5) Close two laser clamps (12).

NOTE

Misalignment of lines can degrade boresight accuracy.

(6) Verify that line on laser (11) is still aligned with forward edge of BRFA.

NOTE

Failure to hook chain may degrade boresight accuracy.

(7) Hook chain (14) to BRFA (1).

j. Install 74D111103 FLIR alignment adapter assembly (FLIR adapter) (2) on FLIR mount attach points per substeps below:

WARNING

Dry cleaning solvent is flammable and toxic. Do not use near open flame or sparks. Avoid breathing vapors. Do not allow contact with skin or eyes. Use only in well ventilated areas.

(1) Clean mating surfaces of FLIR adapter (2) and FLIR mount attach points using cheesecloth moistened with solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

(2) Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.

(3) Make sure attach bolts are clean and free of burrs and damaged threads.

(4) Position FLIR adapter (2) on FLIR mount attach points and install four attach bolts (15, 16, 17, and 18) handtight in the sequence per substeps below:

- (a) Aft lower bolt (17).
- (b) Forward upper bolt (15).
- (c) Aft upper bolt (16).
- (d) Forward lower bolt (18).

(5) Torque four attach bolts (15, 16, 17, and 18) in the sequence and torque per substeps below:

- (a) Torque aft lower bolt (17) 80 ± 10 inch-pounds.
- (b) Torque forward upper bolt (15) 80 ± 10 inch-pounds.
- (c) Torque aft upper bolt (16) 80 ± 10 inch-pounds.
- (d) Torque forward lower bolt (18) 80 ± 10 inch-pounds.

- (e) Torque aft lower bolt (17) 120 ± 10 inch-pounds.
- (f) Torque forward upper bolt (15) 120 ± 10 inch-pounds.
- (g) Torque aft upper bolt (16) 120 ± 10 inch-pounds.
- (h) Torque forward lower bolt (18) 120 ± 10 inch-pounds.
- (i) Torque aft lower bolt (17) 150 ± 10 inch-pounds.
- (j) Torque forward upper bolt (15) 150 ± 10 inch-pounds.
- (k) Torque aft upper bolt (16) 150 ± 10 inch-pounds.
- (l) Torque forward lower bolt (18) 150 ± 10 inch-pounds.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- k. Clean mating surfaces on 74D111167 triaxial detector unit (TDU) (3) and FLIR adapter (2) using cheesecloth moistened with solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

- l. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- m. Make sure attach bolts are clean and free of burrs and damaged threads.
- n. Hold TDU by its carrying handle against attach bushings on FLIR adapter (2).
- o. Engage and snug two upper attach bolts first, then the lower attach bolt.
- p. Hand tighten all three attach bolts (20) the same amount.

NOTE

Failure to hook chain may degrade boresight accuracy.

- q. Hook chain (19) to FLIR adapter (2).

WARNING

Laser radiation, do not look into laser beams or eye injury could occur.

NOTE

The main laser light will illuminate when control/display unit (5) is turned on. When laser energy is not sensed by the TDU after approximately 15 seconds, it will inhibit the laser, causing the main laser light to go off.

- r. Press control/ display unit switch (22) to ON position.

NOTE

The FLIR mount pitch, roll, and yaw indications are displayed on the control/display unit. The PITCH, ROLL, and YAW displays are graduated in 0.01 milliradian increments. Because of equipment sensitivity, five indications should be taken, then use the average of these indications for alignment correction.

If preferred aircraft configuration is used, engines installed and internal fuel cells full, no compensation is required.

Normal equipment operation will allow the displayed ROLL reading to fluctuate as much as ± 0.50 milliradians about a median value. Operator judgement should be used to determine this median roll value.

s. Read and record plus-minus PITCH (21), ROLL (24), and YAW (23) display indications. Record indications to the nearest 0.5 milliradian. If alternate aircraft configuration is used, engines removed or aircraft defueled, compensate pitch indication per substeps below:

(1) Engines installed and aircraft defueled: Decrease pitch indication by 0.5 milliradian and record. Example: Pitch indication was -2.0 milliradians, a decrease of 0.5 milliradian causes indication to now be -2.5 milliradians.

(2) Engines removed and aircraft defueled: Increase pitch indication by 1.0 milliradian and record. Example: Pitch indication was

–2.0 milliradians, an increase of 1.0 milliradian causes indication to now be –1.0 milliradian.

- t. Push control/display unit switch (22) to off position.

NOTE

Electrical boresight compensation assembly has a range from –7.5 to +7.5 milliradians.

- u. If the FLIR mount pitch, roll, and yaw indications are between –7.5 and +7.5 milliradians the electrical boresight compensation assembly (25) shall be used to correct the misalignment. Go to next step.
Indications below –7.5 or above +7.5 milliradians require a depot engineering disposition.
- v. Open door 13R (A1-F18AC-LMM-010).
- w. Remove aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).
- x. Read electrical boresight compensation assembly (25) FLIR, plus-minus PITCH, ROLL, and YAW thumbwheel switches (26) settings.
- y. If FLIR thumbwheel switches are the same as new boresight value, FLIR mount is aligned correctly, go to step af. If not the same, go to next step.

NOTE

Do not turn electrical boresight compensation assembly other system thumbwheel switches as it will cause the affected system to have the wrong boresight compensation data.

- z. Remove guard (10) from electrical boresight compensation assembly (25) by removing attach bolts (8).
 - aa. Input FLIR mount plus-minus pitch, roll, and yaw milliradian indications into the electrical boresight compensation assembly (25) FLIR plus-minus PITCH, ROLL, and YAW thumbwheel switches (26).
 - ab. Record new thumbwheel switch (26) settings on Miscellaneous History Card OPNAV 4790/25A, part of the Aircraft Log Book.
- ac. Verify GUN-MC thumbwheel switch on electrical boresight compensation assembly (25) is set on +2.0 for 161353 THRU 161987 or +2.5 for 162394 AND UP.

NOTE

Setting GUN-MC thumbwheel switch is a factory adjustment and should not be changed.

- ad. Do electrical boresight compensation system test (A1-F18AC-740-200, WP040 00 or A1-F18AE-740-200, WP181 00).
- ae. Install guard (10) with attach bolts (8).
- af. Install aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

- ag. Inspect door 13R for foreign objects.
- ah. Close door 13R (A1-F18AC-LMM-010).
- ai. Remove TDU (3) from FLIR adapter (2) by removing three attach bolts (20) and install on check fixture.
- aj. Remove FLIR adapter (2) from FLIR attach points by removing four attach bolts (15, 16, 17, and 18).
- ak. Remove laser (11) from BRFA (1) per substeps below:
 - (1) Open two laser clamps (12).
 - (2) Unhook chain (14) from BRFA (1).
 - (3) Slide laser forward out of BRFA (1) and install on check fixture.
 - (4) Close two laser clamps (12).
- al. Remove beam splitter assembly (9) from BRFA (1) by removing three attach bolts (13) and install on check fixture.
- am. If all boresighting is completed, remove and stow BRFA (WP009 00).
- an. If all boresighting is completed, remove safety devices, as required (A1-F18AC-PCM-000).
- ao. On 165171 AND UP, install upper chaff dispenser fairing and lower chaff dispenser fairing (A1-F18AC-SRM-430, FIG008 00). 

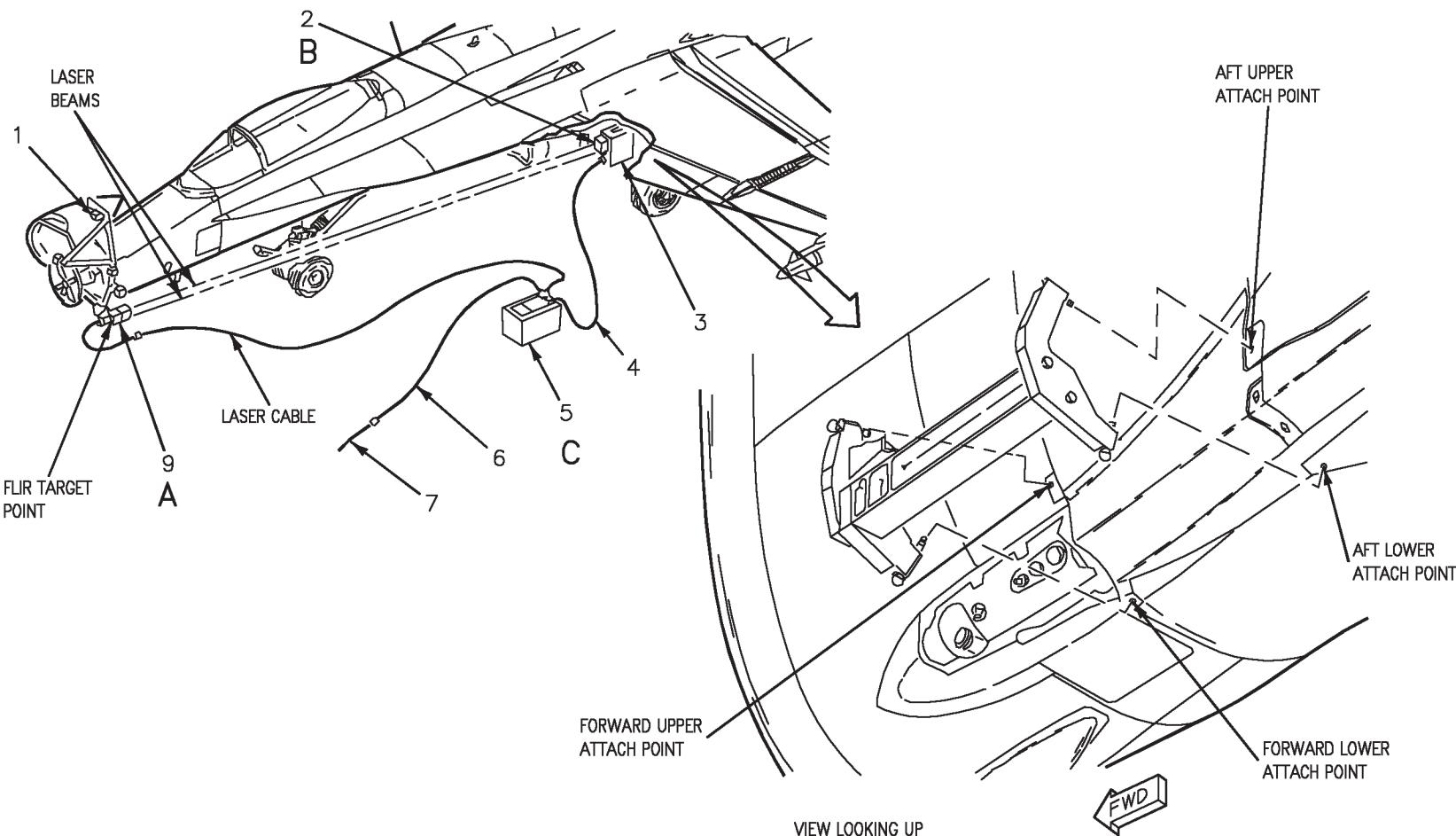


Figure 1. FLIR Mount (Sheet 1)

Figure 1.

Figure 1.

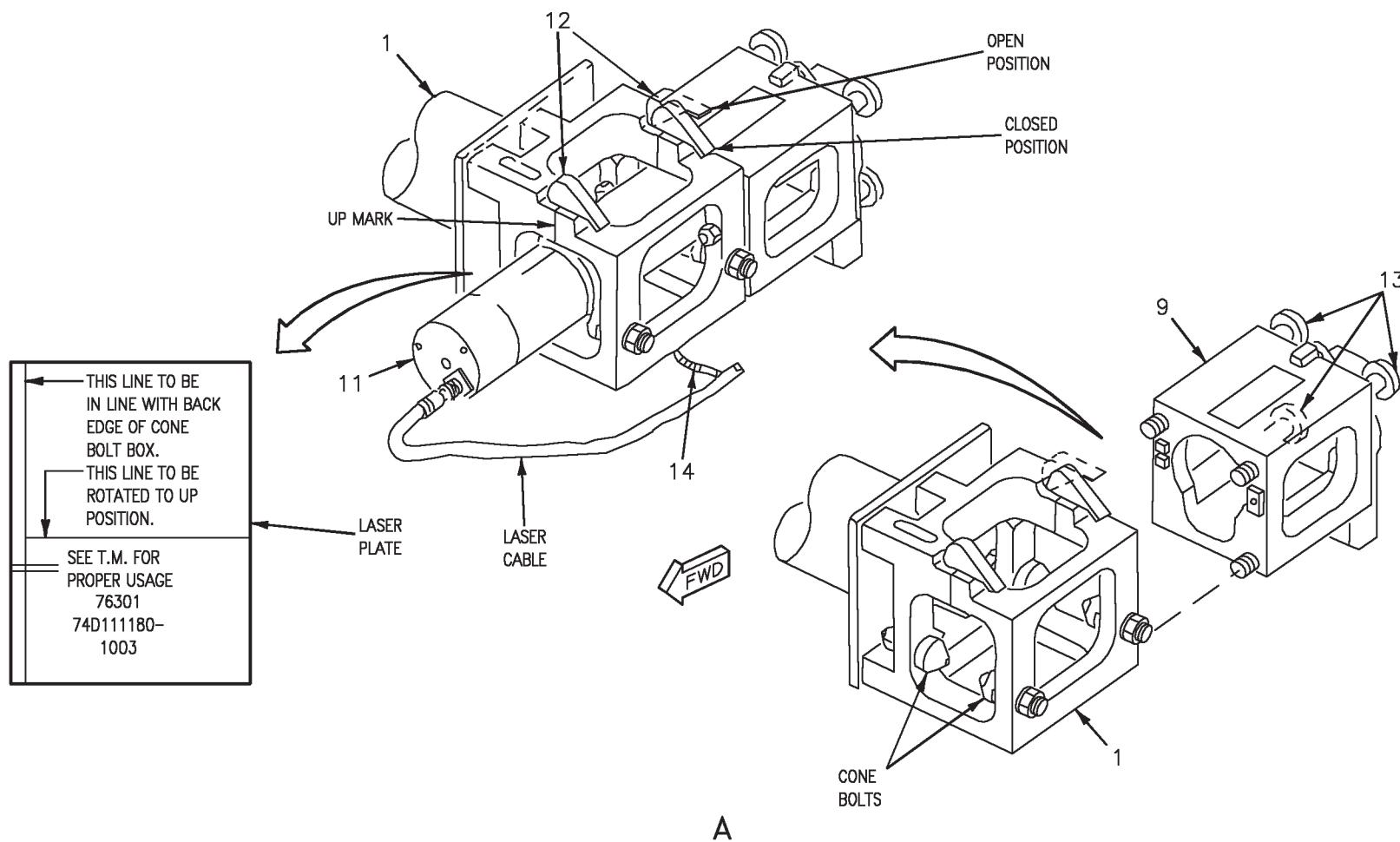
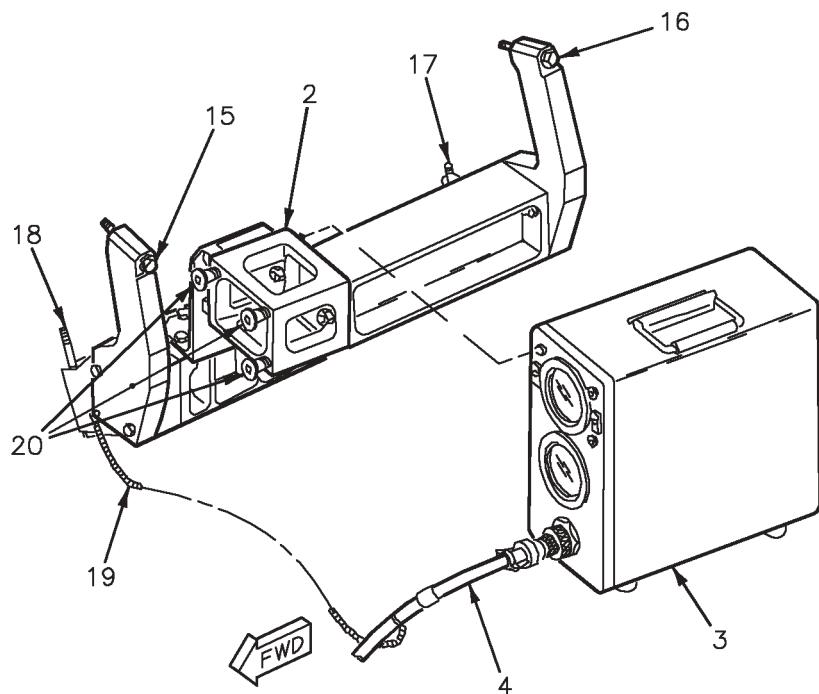
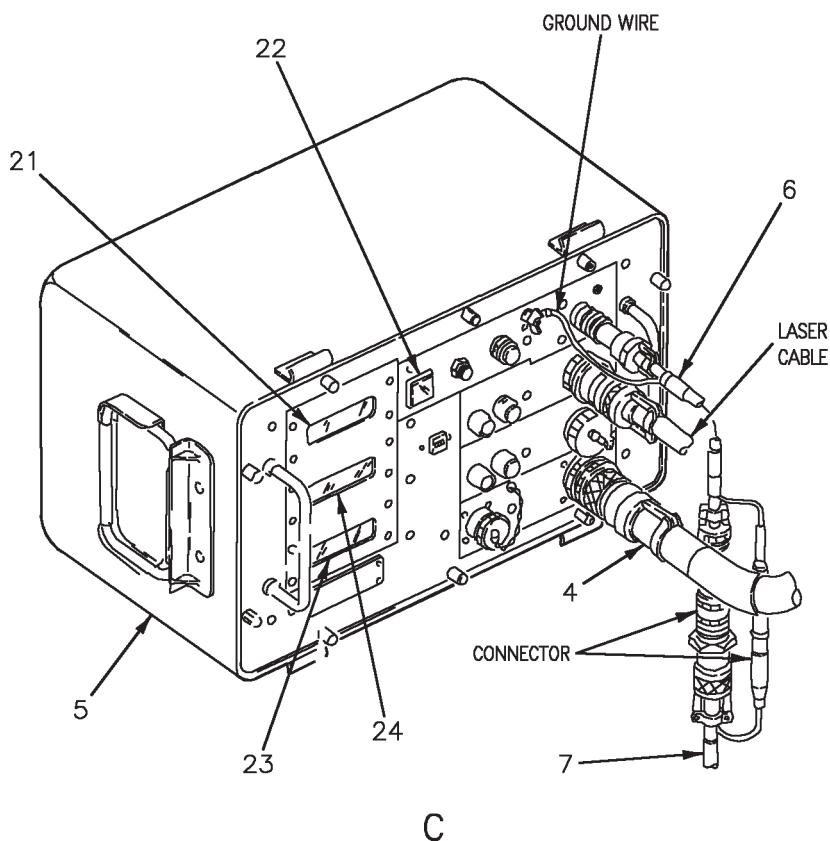


Figure 1. FLIR Mount (Sheet 2)

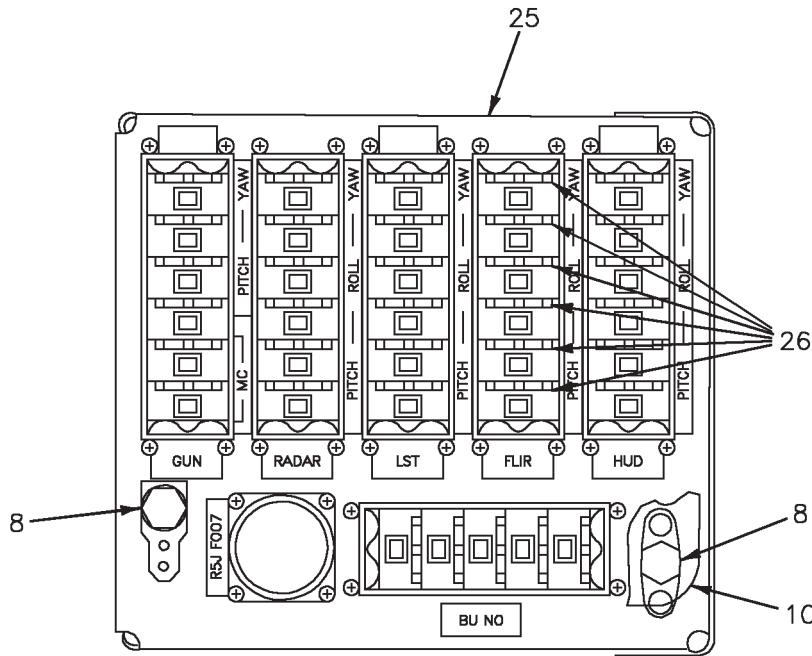
Figure 1.

Figure 1.

**B**



C

**Figure 1. FLIR Mount (Sheet 5)**

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]	Boresight Reference Frame Assembly	74D111115
2 [1]	FLIR Alignment Adapter Assembly	74D111103
3 [2]	Triaxial Detector Unit	74D111167
4 [2]	Cable	74D111145-1001
5 [2]	Control/Display Unit	74D111141
6 [2]	Cable	74D111145-1003
7 [2]	Cable	74D111145-1005
8	Attach Bolt	—
9 [2]	Beam Splitter Assembly	74D111159
10	Guard	74A880682
11 [2]	Laser	74A111180
12	Laser Clamp	—
13	Attach Bolt	—
14	Chain	—
15	Forward Upper Bolt	—
16	Aft Upper Bolt	—
17	Aft Lower Bolt	—
18	Forward Lower Bolt	—
19	Chain	—
20	Attach Bolt	—
21	Pitch Display	—
22	Switch	—
23	Yaw Display	—
24	Roll Display	—
25	Electrical Boresight Compensation Assy.	74A870612
26	Thumbwheel Switch	—

Figure 1. FLIR Mount (Sheet 6)

INDEX NO.	NOMENCLATURE	PART NUMBER
LEGEND		
[1]	Part of 74D110163 boresight alignment set.	
[2]	Part of 74D110021 triaxial alignment set.	

Figure 1. FLIR Mount (Sheet 7)

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****FORWARD LOOKING INFRARED SYSTEM MOUNT****USING 537226 OPTICAL ALIGNMENT SET**

Reference Material

Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Communication, TACAN, ADF, Electronic Al- timeter and IFF Systems.....	A1-F18AC-600-300
Receiver-Transmitter	
RT-1250/ARC-182(V) (76A-F002)	WP003 00
Forward Looking Infrared System.....	A1-F18AC-744-300
Detecting Set AN/AAS-38	WP003 00
Weapon Control Systems	A1-F18AC-740-200
Electrical Boresight Compensation System Test.....	WP040 00
Weapon Control Systems	A1-F18AE-740-200
Electrical Boresight Compensation System Test.....	WP181 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	3
Aircraft Preparation.....	5
Alignment Verification Procedure	5
Introduction.....	2
General Instructions.....	2
Safety Precautions.....	3

Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
SEC 4998	—	Replacement of 74D110021 Triaxial Alignment Set With 537226 Optical Alignment Set. (Alameda ECP 775)	1 Jun 93	—

- 1. INTRODUCTION.**
2. This work package contains organizational level maintenance instructions for boresighting the forward looking infrared system (FLIR) mount attach points. Misalignment is corrected using the electrical boresight compensation assembly.
3. **GENERAL INSTRUCTIONS.** To make sure the FLIR mount is accurately boresighted, the instructions below shall be used:

- a. Due to equipment sensitivity, boresighting should only be done ashore.
- b. Personnel must be familiar with the use and operation of the optical alignment set.
- c. Personnel must know the principles of boresighting.
- d. Boresighting should be done separately from other maintenance operations.
- e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
- f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.
- g. Attach bolts shall be clean and free of burrs and damaged threads.
- h. Visually inspect for loose or missing sealant around nuts on equipment.
- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

4. SAFETY PRECAUTIONS.

- 5. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

6. AIRCRAFT BORESIGHT REQUIREMENTS.

7. Aircraft structural flexing affects FLIR boresight accuracy. To control the effect of this flexing and to be sure the mount boresight is accurate, make sure the aircraft is as listed below:

a. Forward fuselage:

- (1) Make sure all armament, avionics, electrical equipment, and/or ballast forward of the nose gear is installed.
- (2) Make sure ammunition drum is empty.
- (3) Make sure windshield is closed.
- (4) Make sure door 3 is closed (A1-F18AC-LMM-010).

b. Cockpit(s): Make sure no personnel, tools, and/or equipment are in cockpit.

c. Center and aft fuselage: Preferred configuration is engines installed and internal fuel cells full. However, two alternate configurations may be used: engines installed with aircraft defueled or engines removed with aircraft defueled. If alternate configuration is used, pitch compensation is required during boresighting.

d. External stores:

- (1) Pylons, weapon launcher and/or ejector racks may be installed on all stations in any combination.
- (2) Empty external fuel tanks and wing tip sidewinders may be installed.
- (3) Laser detector-tracker-strike camera set may be installed.

8. AIRCRAFT PREPARATION.

- a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).
- b. Remove Detecting Set AN/AAS-38 (A1-F18AC-744-300, WP003 00).
- c. On 165171 AND UP, remove upper chaff dispenser fairing and lower chaff dispenser fairing (A1-F18AC-SRM-430, FIG008 00). █

9. ALIGNMENT VERIFICATION PROCEDURE. See figure 1.**Support Equipment Required**

Part Number or Type Designation	Nomenclature
--	---------------------

74D110163-1001	Boresight Alignment Set
537226	Optical Alignment Set
—	Torque Wrench, 0 to 200 Inch-Pounds

Materials Required

Specification or Part Number	Nomenclature
-------------------------------------	---------------------

CCC-C-440 TYPE 1, CLASS 1	Cheesecloth
P-D-680,TYPE 2	Dry Cleaning Solvent

- a. Verify alignment of optical alignment set (WP010 02).
- b. Set up and install boresight reference frame assembly (BRFA) (1) (WP009 00).

WARNING

Dry cleaning solvent is flammable and toxic. Do not use near open flame or sparks. Avoid breathing vapors. Do not allow contact with skin or eyes. Use only in well ventilated areas.

- c. Clean attach points on FLIR alignment adapter (11) and mating surfaces on fuselage using clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

- d. Visually inspect attach points to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- e. Make sure attach bolts are clean and free of burrs and damaged threads.
- f. Support FLIR alignment adapter (11) on fuselage attach points and install four attach bolts (17, 18, 19, and 20) handtight in the sequence per substeps below:

- (1) Aft lower bolt (20).
- (2) Forward upper bolt (17).
- (3) Aft upper bolt (19).
- (4) Forward lower bolt (18).



Improper torquing of adapters can adversely affect the accuracy of boresight readings. Complying with the following torque sequences and torque values is critical.

g. Torque four attach bolts (17, 18, 19, and 20) in the sequence and torque per substeps below:

- (1) Torque aft lower bolt (20) 80 ± 10 inch-pounds.
- (2) Torque forward upper bolt (17) 80 ± 10 inch-pounds.
- (3) Torque aft upper bolt (19) 80 ± 10 inch-pounds.
- (4) Torque forward lower bolt (18) 80 ± 10 inch-pounds.
- (5) Torque aft lower bolt (20) 120 ± 10 inch-pounds.
- (6) Torque forward upper bolt (17) 120 ± 10 inch-pounds.
- (7) Torque aft upper bolt (19) 120 ± 10 inch-pounds.
- (8) Torque forward lower bolt (18) 120 ± 10 inch-pounds.

- (9) Torque aft lower bolt (20) 150 ± 10 inch-pounds.
- (10) Torque forward upper bolt (17) 150 ± 10 inch-pounds.
- (11) Torque aft upper bolt (19) 150 ± 10 inch-pounds.
- (12) Torque forward lower bolt (18) 150 ± 10 inch-pounds.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- h. Clean attach points on optical reference measurement unit (2), target mirror assembly (10) and FLIR alignment boxes (15) and (16) using clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

- i. Visually inspect attach points to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- j. Make sure attach bolts are clean and free of burrs and damaged threads.

- k. Lift optical reference measurement unit (2) by its carrying handle, hold against FLIR alignment box (15) attach points.
- l. Engage and snug two upper attach bolts first, then the lower attach bolt.
- m. Hand tighten all three attach bolts (4) the same amount.
- n. Position optical target monitor (3) close to optical reference measurement unit (2) so video display (8) may be viewed while adjusting pitch and yaw micrometers (13) and (14).
- o. Connect cable (6) to optical target monitor (3) and optical reference measurement unit (2).
- p. Position target mirror assembly (10) on FLIR alignment box (16) attach points.
- q. Engage and snug two upper attach bolts first, then the lower attach bolt.
- r. Hand tighten all three attach bolts (9) the same amount.
- s. Connect cable (7) to optical target monitor (3) and target mirror assembly (10).
- t. Connect power cable (5) to optical target monitor (3).
- u. Plug power cable (5) to electrical power source.

- x. Switch optical target monitor power switch (12) to ON.

NOTE

Do not adjust roll setting potentiometer (26).

- y. View video display (8) for crosshair position on target rings. If required, adjust pitch and yaw micrometers (13) and (14) by rotating pitch and yaw micrometer spindles (21) and (22) to get centering of crosshairs on target rings.

- z. Read and record plus-minus PITCH (23), ROLL (24), and YAW (25) display indications from optical target monitor (3). Record indications to the nearest 0.5 milliradian.

- aa. Switch optical target monitor power switch (12) to OFF.

NOTE

If preferred aircraft configuration is used, engines installed and internal fuel cells full, no compensation is required.

- ab. If alternate aircraft configuration is used, engines removed or aircraft defueled, compensate pitch indication per substeps below:

- (1) Engines installed and aircraft defueled: Decrease pitch indication by 0.5 milliradian and record. Example: Pitch indication was -2.0 milliradians, a decrease of 0.5 milliradian causes indication to now be -2.5 milliradians.

(2) Engines removed and aircraft defueled: Increase pitch indication by 1.0 milliradian and record. Example: Pitch indication was -2.0 milliradians, an increase of 1.0 milliradian causes indication to now be -1.0 milliradian.

NOTE

Electrical boresight compensation assembly has a range from -7.5 to $+7.5$ milliradians.

ac. If the FLIR mount pitch, roll, and yaw indications are between -7.5 and $+7.5$ milliradians the electrical boresight compensation assembly (27) shall be used to correct the misalignment. Go to next step. Indications below -7.5 or above $+7.5$ milliradians require a depot engineering disposition.

ad. Open door 13R (A1-F18AC-LMM-010).

ae. Remove aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

af. Read electrical boresight compensation assembly (27) FLIR, plus-minus PITCH, ROLL, and YAW thumbwheel switches (28) settings.

ag. If FLIR thumbwheel switches are the same as new boresight value, FLIR mount is aligned correctly, go to step an. If not the same, go to next step.

NOTE

Do not turn electrical boresight compensation assembly other system thumbwheel switches as it will cause the affected system to have the wrong boresight compensation data.

- ah. Remove guard (29) from electrical boresight compensation assembly (27) by removing attach bolts (30).
- ai. Input FLIR mount plus-minus pitch, roll, and yaw milliradian indications into the electrical boresight compensation assembly (27) FLIR plus-minus PITCH, ROLL, and YAW thumbwheel switches (28).
- aj. Record new thumbwheel switch (28) settings on Miscellaneous History Card OPNAV 4790/25A, part of the Aircraft Log Book.

NOTE

Setting GUN-MC thumbwheel switch is a factory adjustment and should not be changed.

- ak. Verify GUN-MC thumbwheel switch on electrical boresight compensation assembly (27) is set on +2.0 for 161353 THRU 161987 or +2.5 for 162394 AND UP.
 - al. Do electrical boresight compensation system test (A1-F18AC-740-200, WP040 00 or A1-F18AE-740-200, WP181 00).
 - am. Install guard (29) with attach bolts (30).
 - an. Install aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

ao. Inspect door 13R for foreign objects.

ap. Close door 13R (A1-F18AC-LMM-010).

aq. Unplug power cable (5) from electrical power source.

ar. Disconnect power cable (5) from optical target monitor (3).

as. Disconnect cable (7) from optical target monitor (3) and target mirror assembly (10).

at. Disconnect cable (6) from optical target monitor (3) and optical reference measurement unit (2).

au. Remove target mirror assembly (10) from FLIR alignment box (16).

av. Remove optical reference measurement unit (2) from FLIR alignment box (15).

aw. Remove FLIR alignment adapter (11) from fuselage attach points by removing four attach bolts (17, 18, 19, and 20).

ax. Replace all boresighting equipment to correct storage areas.

ay. If all boresighting is completed, remove and stow BRFA (1) (WP009 00).

az. If all boresighting is completed, remove safety devices, as required (A1-F18AC-PCM-000).

ba. On 165171 AND UP, install upper chaff dispenser fairing and lower chaff dispenser fairing (A1-F18AC-SRM-430, FIG008 00). 

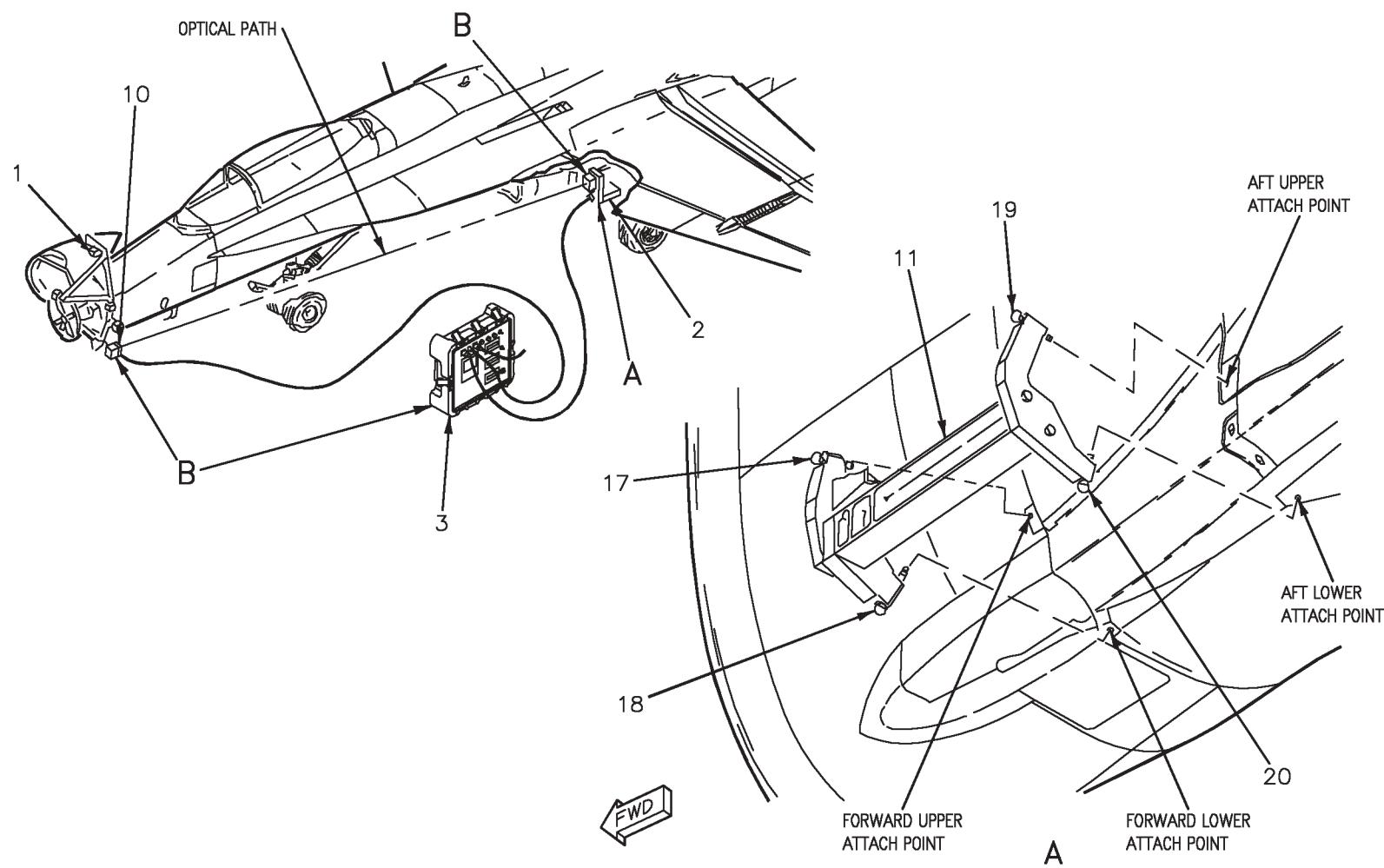


Figure 1. FLIR Mount (Sheet 1)

Figure 1.

Figure 1.

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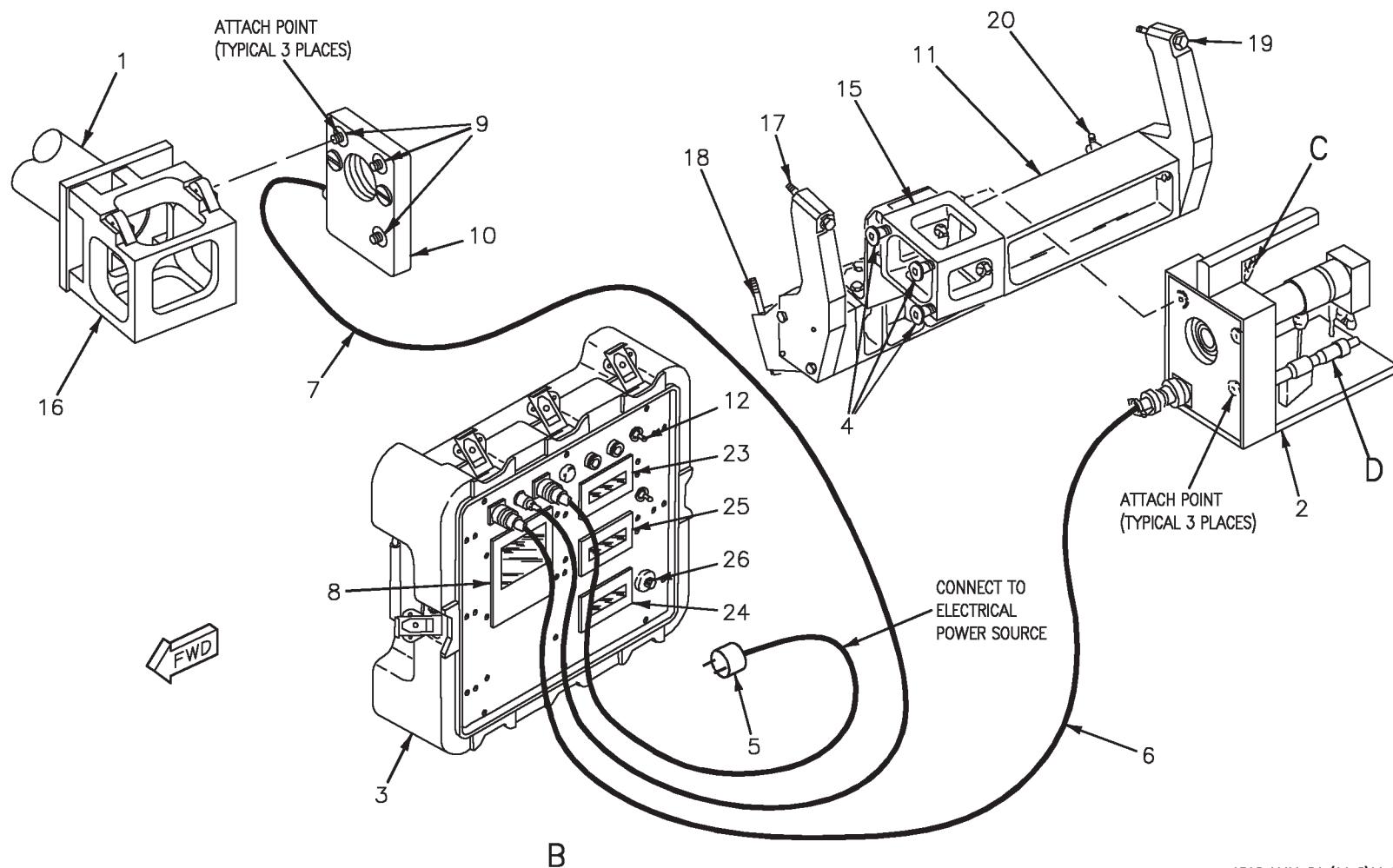
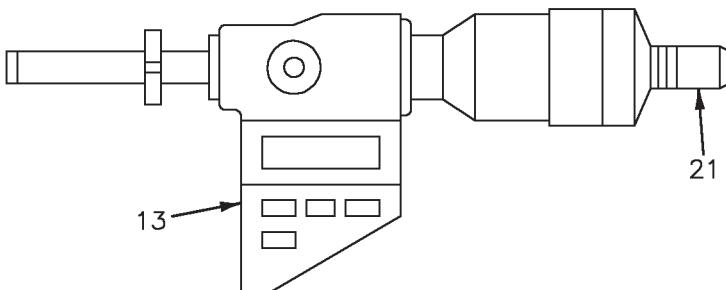


Figure 1. FLIR Mount (Sheet 2)

Figure 1.

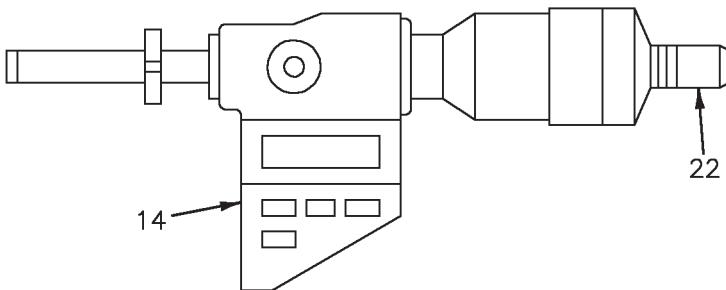
18AC-LMM-04-(14-2)11-SCAN

Figure 1.



PITCH MICROMETER

C

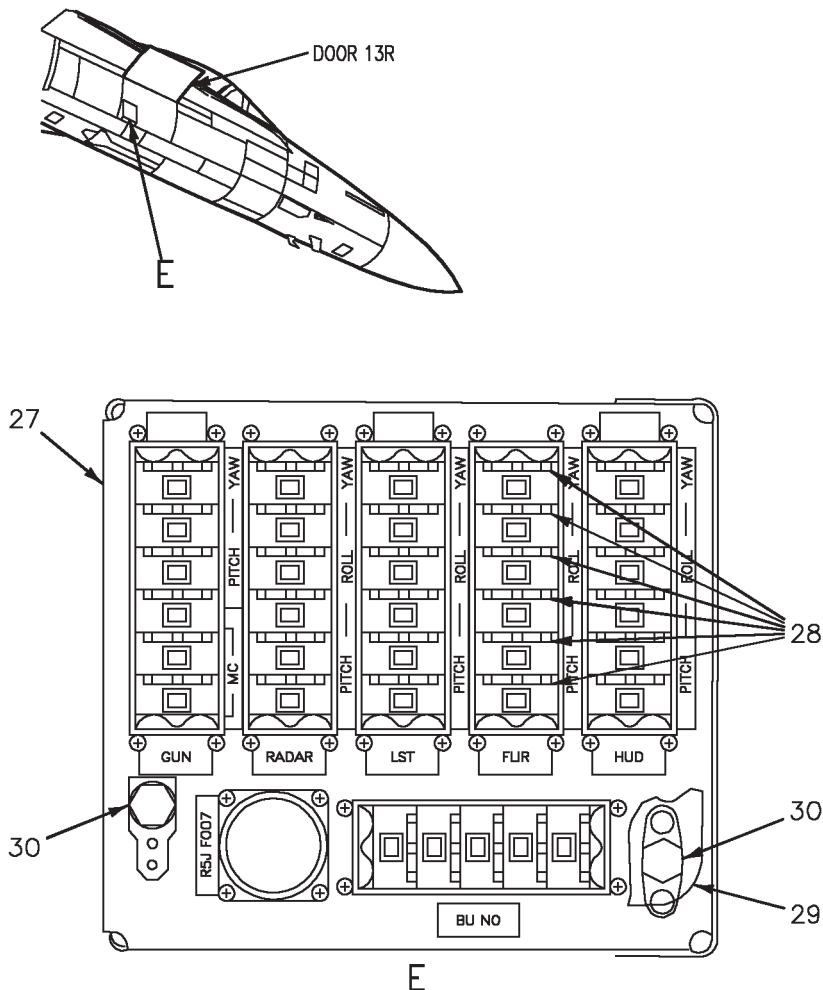


YAW MICROMETER

D

18AC-LMM-04-(14-3)11-CATI

Figure 1. FLIR Mount (Sheet 3)



18AC-LMM-04-(14-4)11-CATI

Figure 1. FLIR Mount (Sheet 4)

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]	Boresight Reference Frame Assembly	74D111115
2 [2]	Optical Reference Measurement Unit	537227
3 [2]	Optical Target Monitor	437228
4	Attach Bolts	—
5 [2]	Power Cable	437230-1
6 [2]	Cable	437230-2
7 [2]	Cable	437230-3
8	Video Display	—
9	Attach Bolts	—
10 [2]	Target Mirror Assembly	437232
11 [1]	FLIR Alignment Adapter	74D111103
12	Power Switch	—
13	Micrometer, Pitch	—
14	Micrometer, Yaw	—
15	FLIR Alignment Box	—
16	FLIR Alignment Box (BRFA)	—
17	Forward Upper Bolt	—
18	Forward Lower Bolt	—
19	Aft Upper Bolt	—
20	Aft Lower Bolt	—
21	Micrometer Spindle, Pitch	—
22	Micrometer Spindle, Yaw	—
23	Digital Display, Pitch	—
24	Digital Display, Roll	—
25	Digital Display, Yaw	—
26	Roll-Adjust Zero Potentiometer	—

Figure 1. FLIR Mount (Sheet 5)

INDEX NO.	NOMENCLATURE	PART NUMBER
27	Electrical Boresight Compensation Assy.	74A870612
28	FLIR Thumbwheel Switch	—
29	Guard	74A880682
30	Attach Bolt	—
LEGEND		
[1]	Part of 74D110163 boresight alignment set.	
[2]	Part of 537226 optical alignment set.	

Figure 1. FLIR Mount (Sheet 6)

A1-F18AC-LMM-040

1 June 1993

008 00

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ORGANIZATIONAL MAINTENANCE

LINE MAINTENANCE BORESIGHTING DATA

LASER DETECTOR TRACKER SYSTEM MOUNT

Title	WP Number
Laser Detector Tracker System Mount	
Using 74D110021 Triaxial Alignment Set	008 01
Using 537226 Optical Alignment Set	008 02

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****LASER DETECTOR TRACKER SYSTEM MOUNT****USING 74D110021 TRIAXIAL ALIGNMENT SET**

Reference Material

Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Communication, TACAN, ADF, Electronic Al-	
timeter and IFF Systems.....	A1-F18AC-600-300
Receiver-Transmitter	
RT-1250/ARC-182(V) (76A-F002)	WP003 00
Laser Detector Tracker System	A1-F18AC-743-300
Mounting Adapter MT-6082/ASQ-173	WP005 00
Weapon Control Systems	A1-F18AC-740-200
Electrical Boresight Compensation	
System Test.....	WP040 00
Weapon Control Systems	A1-F18AE-740-200
Electrical Boresight Compensation	
System Test.....	WP181 00
Navigation Infrared Receiving System	A1-F18AG-746-300
Mounting-Adapter MT-6512/AAR-50	WP003 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	4
Aircraft Preparation.....	5
Alignment Verification Procedure	5
Introduction.....	2
General Instructions.....	2
Safety Precautions.....	3

Record of Applicable Technical Directives

None

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for boresighting the laser detector tracker system (LDT) mount attach points located on lower right side of the center fuselage. Misalignment is corrected using the electrical boresight compensation assembly.

3. **GENERAL INSTRUCTIONS.** To make sure the mount is accurately boresighted, the instructions below shall be used:

a. Due to equipment sensitivity, boresighting should only be done ashore.

b. Personnel must be familiar with the use and operation of the triaxial alignment set.

- c. Personnel must know the principles of boresighting.
- d. Boresighting should be done separately from other maintenance operations.
- e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
- f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.
- g. Attach bolts shall be clean and free of burrs and damaged threads.
- h. Visually inspect for loose or missing sealant around nuts on equipment.
- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

4. SAFETY PRECAUTIONS.**WARNING**

Laser radiation, do not look into laser beams or eye injury could occur.

- a. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

5. AIRCRAFT BORESIGHT REQUIREMENTS.

6. Aircraft structural flexing affects LDT boresight accuracy. To control the effect of this flexing and to be sure the mount boresight is accurate, make sure the aircraft is as listed below:

a. Forward fuselage:

- (1) Make sure all armament, avionics electrical equipment, and/or ballast forward of the nose gear is installed.
- (2) Make sure ammunition drum is empty.
- (3) Make sure windshield is closed.
- (4) Make sure door 3 is closed (A1-F18AC-LMM-010).

b. Cockpit(s): Make sure no personnel, tools, and/or equipment are in cockpit.

c. Center and aft fuselage: Preferred configuration is engines installed and internal fuel cells full. However, two alternate configurations may be used: engines installed with aircraft defueled and engines removed with aircraft defueled. If alternate configuration is used, pitch compensation is required during boresighting.

d. External stores:

(1) Pylons, weapon launcher and/or ejector racks may be installed on all stations in any combination.

(2) Empty external fuel tanks and wing tip sidewinders may be installed.

(3) Forward looking infrared system may be installed.

7. AIRCRAFT PREPARATION.

a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

b. Remove Mounting Adapter MT-6082/ASQ-173, if installed (A1-F18AC-743-300, WP005 00).

c. Remove Mounting Adapter MT-6512/AAR-50, if installed (A1-F18AG-746-300, WP003 00).

8. ALIGNMENT VERIFICATION PROCEDURE. See figure 1.

Support Equipment Required

Part Number or Type Designation	Nomenclature
74D110163-1001 (74D110154-1001)	Boresight Alignment Set (Laser Detector Tracker Mount Alignment Adapter)
74D110021-1003 (74D110021-1001) —	Triaxial Alignment Set Torque Wrench, 0 to 200 Inch-Pounds

Materials Required**Specification
or Part Number****Nomenclature**

CCC-C-440 TYPE 1
CLASS 1
P-D-680
TYPE 2

Cheesecloth
Dry Cleaning Solvent

- a. Verify alignment of triaxial alignment set (WP010 01).
- b. Set up and install boresight reference frame assembly (BRFA) (WP009 00).

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- c. Clean attach bushing mating surfaces at LDT target point on BRFA and 74D111159 beam splitter(4) by wiping with clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings

- d. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- e. Make sure attach bolts are clean and free of burrs and damaged threads.
- f. Lift 74D111159 beam splitter (4) by the box frame near the top against BRFA (1) at LDT target point.
- g. Engage and snug two upper attach bolts first, then the lower attach bolt.
- h. Hand tighten all three attach bolts (12) the same amount.
- i. Install 74D111180 laser (2) on cone bolts in BRFA (1) at LDT target point per substeps below:
 - (1) Wipe all oil and fingerprints from steel tube using clean cheesecloth.
 - (2) Open two laser clamps (13).
 - (3) Slide laser (2) aft into BRFA (1) and beam splitter assembly (4) until line on laser plate is aligned with forward edge of cone bolt box on BRFA.
 - (4) Rotate laser (2) to align line on laser plate with up mark on BRFA (1).

(5) Close two laser clamps (13).

NOTE

Misalignment of lines can degrade boresight accuracy.

(6) Verify that line on laser plate is still aligned with mark on BRFA (1).

NOTE

Failure to hook chain may degrade boresight accuracy.

(7) Hook chain (14) to BRFA (1).

WARNING

Dry cleaning solvent is flammable and toxic. Do not use near open flame or sparks. Avoid breathing vapors. Do not allow contact with skin or eyes. Use only in well ventilated areas.

j. Clean mating surfaces of LDT adapter (11) and LDT attach points using cheesecloth moistened with solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

k. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.

l. Make sure attach bolts are clean and free of burrs and damaged threads.

m. Support LDT adapter (11) on LDT attach points and install four attach bolts (16, 17, 18, and 20) handtight in the sequence per substeps below:

- (1) Forward lower bolt (18).
- (2) Aft upper bolt (16).
- (3) Forward upper bolt (17).
- (4) Aft lower bolt (20).



Improper torquing of adapters can adversely affect the accuracy of boresight readings. Complying with the following torque sequences and torque values is critical.

n. Torque four attach bolts (16, 17, 18, and 20) in the sequence and torque per substeps below:

- (1) Torque forward lower bolt (18) to 80 ± 10 inch-pounds.
- (2) Torque aft upper bolt (16) to 80 ± 10 inch-pounds.
- (3) Torque forward upper bolt (17) to 80 ± 10 inch-pounds.
- (4) Torque aft lower bolt (20) to 80 ± 10 inch-pounds.
- (5) Torque forward lower bolt (18) to 120 ± 10 inch-pounds.
- (6) Torque aft upper bolt (16) to 120 ± 10 inch-pounds.
- (7) Torque forward upper bolt (17) to 120 ± 10 inch-pounds.
- (8) Torque aft lower bolt (20) to 120 ± 10 inch-pounds.
- (9) Torque forward lower bolt (18) to 150 ± 10 inch-pounds.
- (10) Torque aft upper bolt (16) to 150 ± 10 inch-pounds.
- (11) Torque forward upper bolt (17) to 150 ± 10 inch-pounds.
- (12) Torque aft lower bolt (20) to 150 ± 10 inch-pounds.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- o. Clean mating surfaces of 74D111167 triaxial detector unit (TDU) (10) and LDT adapter (11) using cheesecloth moistened with solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings.

- p. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- q. Make sure attach bolts are clean and free of burrs and damaged threads.
- r. Lift TDU (10) by its carrying handle, hold against LDT adapter (11).
- s. Engage and snug two upper attach bolts first, then the lower attach bolt.
- t. Hand tighten all three attach bolts (15) the same amount.

NOTE

Failure to hook chain may degrade boresight accuracy.

- u. Hook chain (19) to LDT adapter (11).

WARNING

Laser radiation, do not look into laser beams or eye injury could occur.

NOTE

The main laser light will illuminate when control/display unit (6) is turned on. When laser energy is not sensed by the TDU after approximately 15 seconds, it will inhibit the laser, causing the main laser light to go off.

- v. Press control/display unit switch (22) to ON position.

NOTE

The LDT mount pitch, roll, and yaw indications are displayed on the control/display unit. The PITCH, ROLL, and YAW displays are graduated in 0.01 milliradian increments. Because of equipment sensitivity, five indications should be taken, then use the average of these indications for alignment correction.

If preferred aircraft configuration is used, engines installed and internal fuel cells full, no compensation is required.

Normal equipment operation will allow the displayed ROLL reading to fluctuate as much as ± 0.50 milliradians about a median value. Operator judgement should be used to determine this median roll value.

w. Read and record plus-minus PITCH (21), ROLL (24), and YAW (23) display indications. Record indications to the nearest 0.5 milliradian. If alternate aircraft configuration is used, engines removed or aircraft defueled, compensate pitch indication per substeps below:

(1) Engines installed and aircraft defueled: Decrease pitch indication by 0.5 milliradian and record. Example: Pitch indication was -2.0 milliradians, a decrease of 0.5 milliradian causes indication to now be -2.5 milliradians.

(2) Engines removed and aircraft defueled: Increase pitch indication by 1.0 milliradian and record. Example: Pitch indication was -2.0 milliradians, an increase of 1.0 milliradian causes indication to now be -1.0 milliradian.

- x. Push control/display unit switch (22) to off position.

NOTE

Electrical boresight compensation assembly has a range from -7.5 to $+7.5$ milliradians.

y. If the LDT mount pitch, roll, and yaw indications are between -7.5 and $+7.5$ milliradians, the electrical boresight compensation assembly (25) shall be used to correct the misalignment. Go to next step. Indications below -7.5 or above $+7.5$ milliradians require an depot engineering disposition.

- z. Open door 13R (A1-F18AC-LMM-010).

aa. Remove aft Receiver-Transmitter, RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

ab. Read electrical boresight compensation assembly (25) LDT, plus-minus PITCH, ROLL, and YAW thumbwheel switches (26) settings. Switches are identified as LST.

ac. If LDT thumbwheel switches are the same as new boresight values, LDT mount is aligned correctly, go to step aj. If not the same, go to next step.

NOTE

Do not turn electrical boresight compensation assembly other system thumbwheel switches as it will cause the affected system to have the wrong boresight compensation data.

- ad. Remove guard (5) from electrical boresight compensation assembly (25) by removing attach bolts (3).
- ae. Input LDT mount plus-minus pitch, roll, and yaw milliradian indications into the electrical boresight compensation assembly plus-minus PITCH, ROLL, and YAW thumbwheel switches (26), marked LST.
- af. Record new thumbwheel switch (26) settings on Miscellaneous History Card OPNAV 4790/25A, part of the Aircraft Log Book.

NOTE

Setting GUN-MC thumbwheel switch is a factory adjustment and should not be changed.

- ag. Verify GUN-MC thumbwheel switch on electrical boresight compensation assembly (25) is set on +2.0 for 161353 THRU 161987 or +2.5 for 162394 AND UP.
- ah. Do electrical boresight compensation system test (A1-F18AC-740-200, WP040 00 or A1-F18AE-740-200, WP181 00).
- ai. Install guard (5) with attach bolts (3).

- aj. Install aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).
- ak. Inspect door 13R for foreign objects.
- al. Close door 13R (A1-F18AC-LMM-010).
- am. Remove TDU (10) from LDT adapter (11) by removing three attach bolts (15) and install on check fixture.
- an. Remove LDT adapter (11) from LDT attach points by removing four attach bolts (16, 17, 18, and 20).
- ao. Remove laser (2) from BRFA (1) per substeps below:
 - (1) Open two laser clamps (13).
 - (2) Unhook chain (14) from BRFA (1).
 - (3) Slide laser forward out of BRFA (1) and install on check fixture.
 - (4) Close two laser clamps (13).
- ap. Remove beam splitter assembly (4) from BRFA (1) by removing three attach bolts (12) and install on check fixture.
- aq. If all boresighting is completed, remove and stow BRFA (WP009 00).
- ar. If all boresighting is completed, remove safety devices, as required (A1-F18AC-PCM-000).

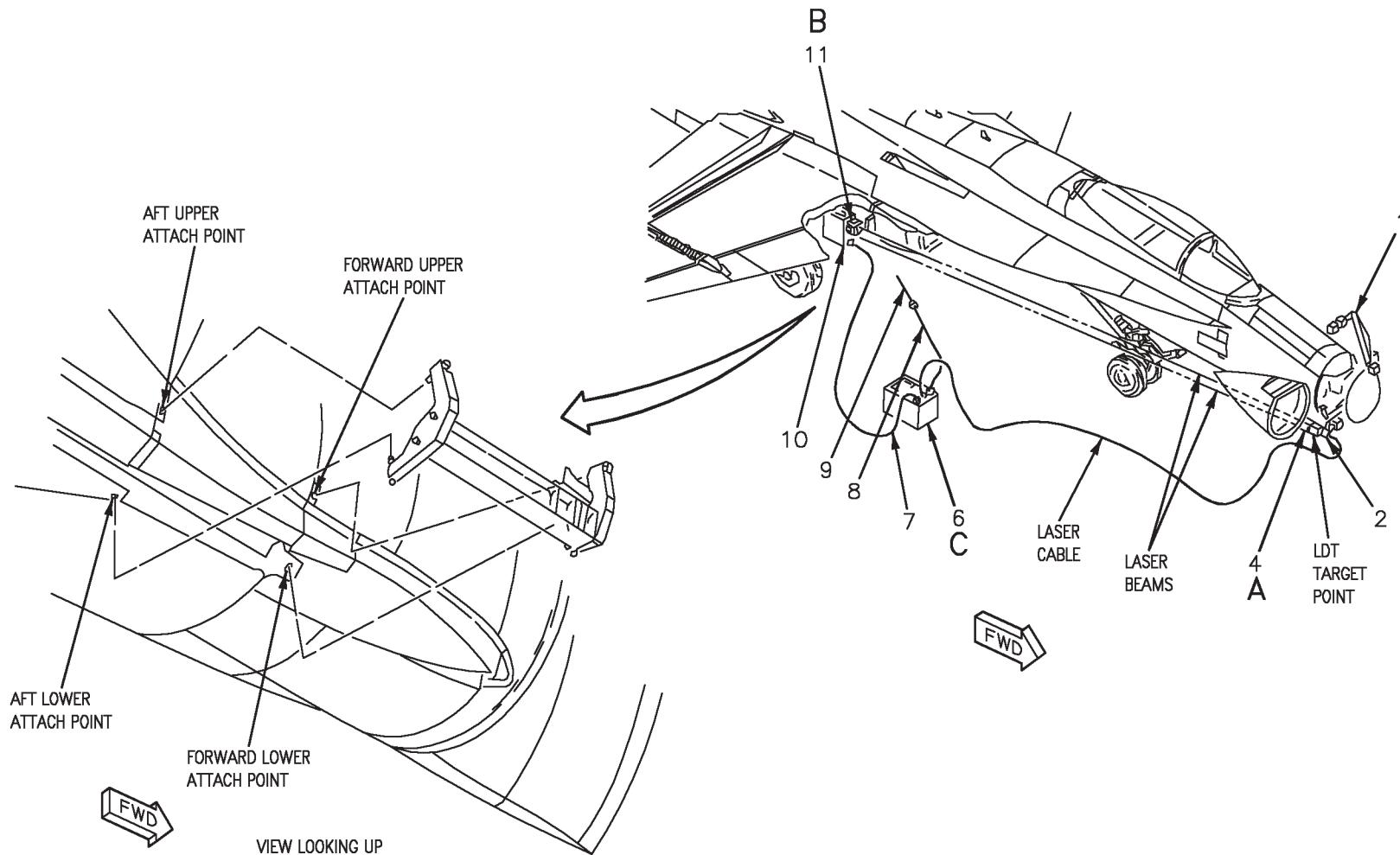


Figure 1. LDT Mount (Sheet 1)

Figure 1.

18AC-LMM-04-(5-1)11-CATI

Figure 1.

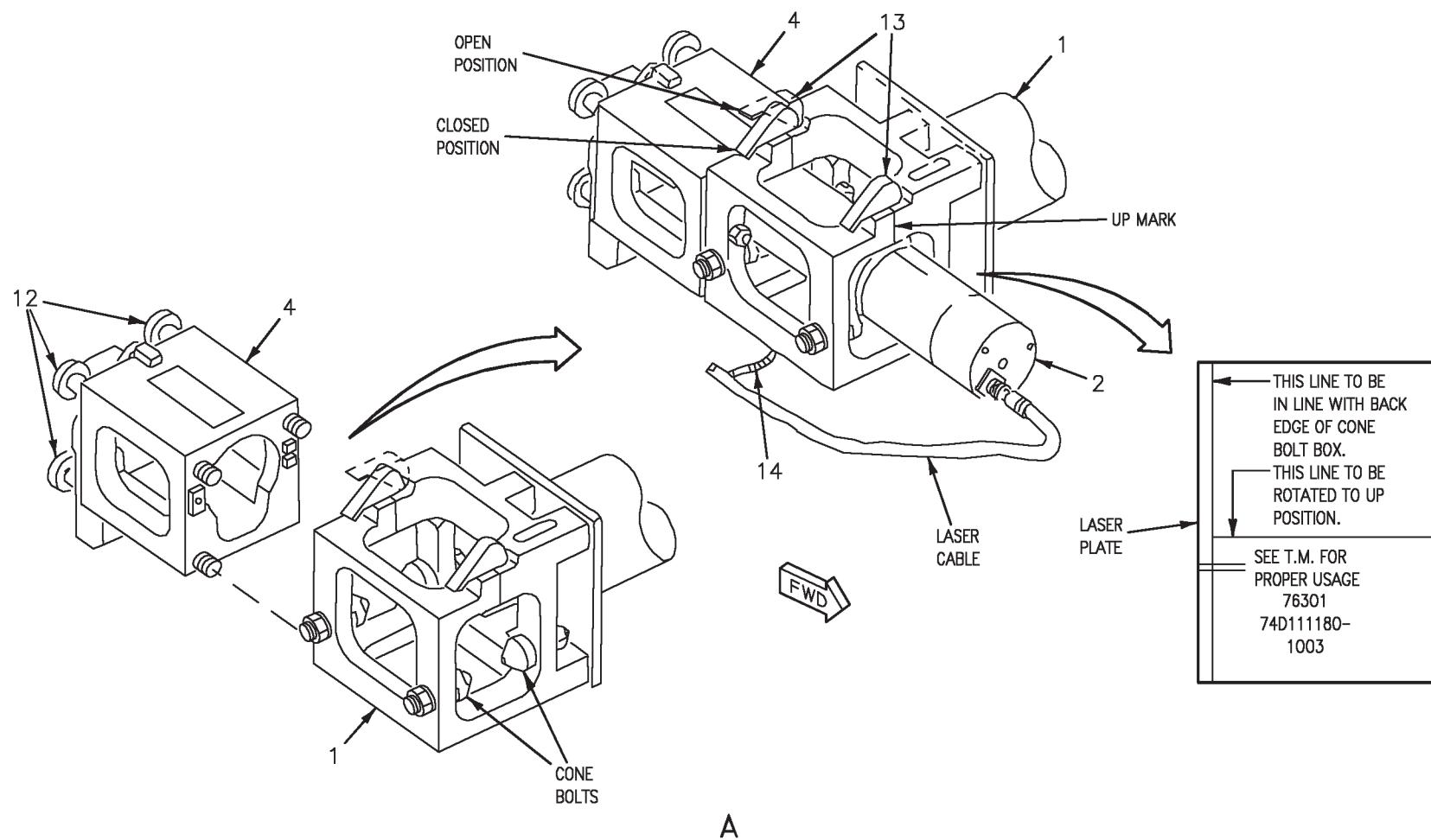
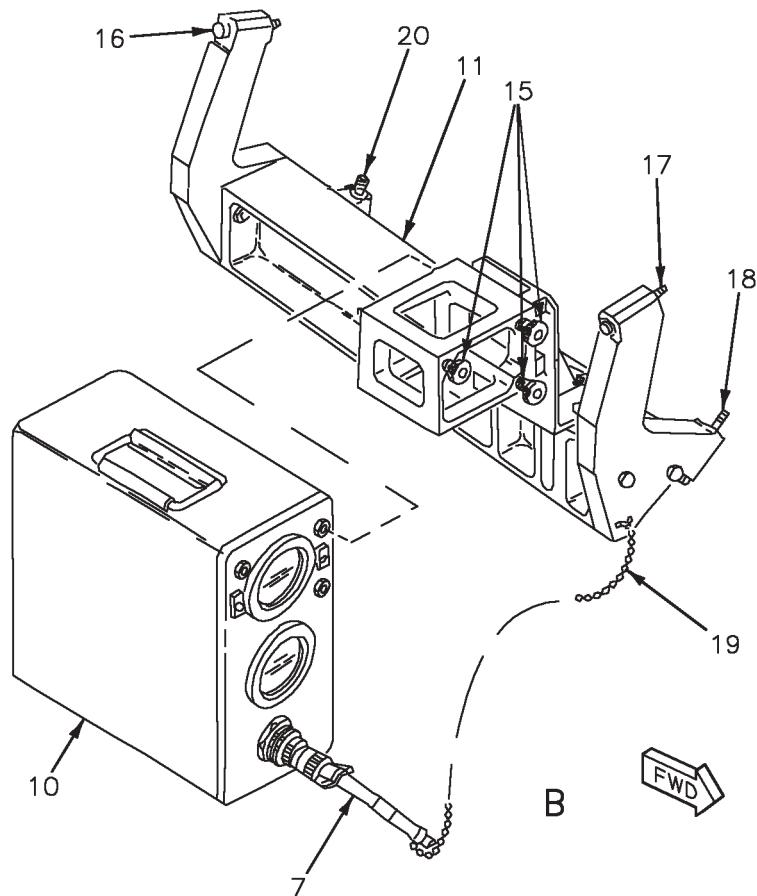


Figure 1. LDT Mount (Sheet 2)

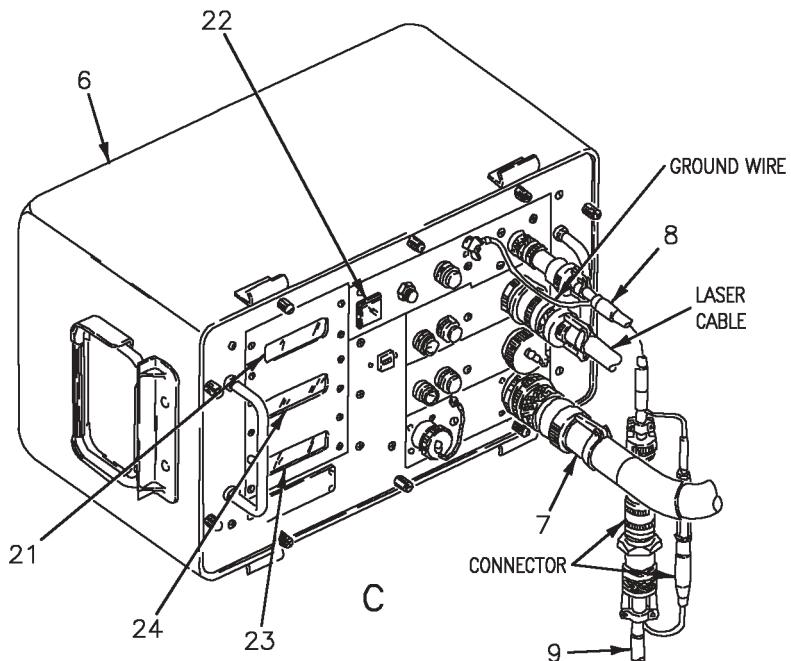
Figure 1.

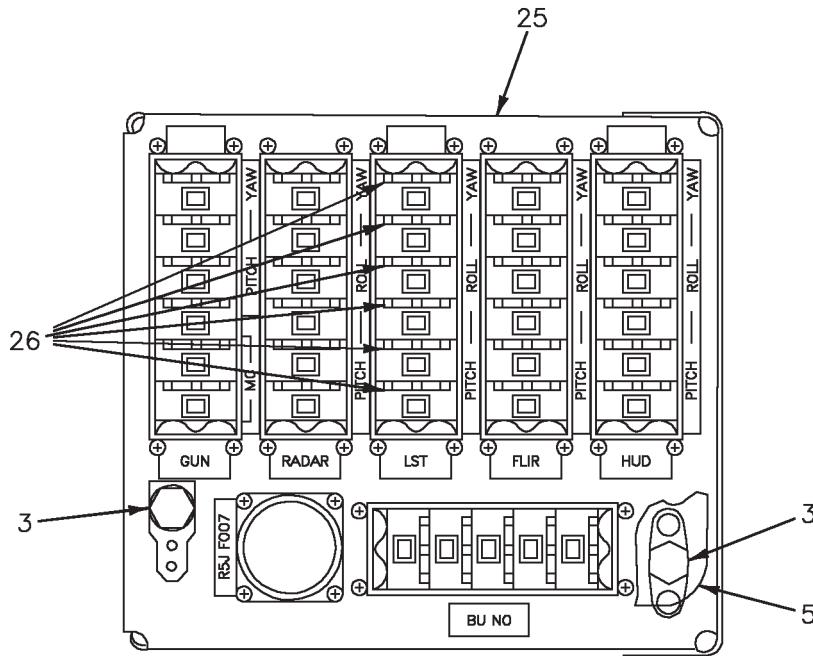
Figure 1.



18AC-LMM-04-(5-3)11-SCAN

Figure 1. LDT Mount (Sheet 3)



**Figure 1. LDT Mount (Sheet 5)**

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]	Boresight Reference Frame Assembly	74D111115
2 [2]	Laser	74D111180
3	Attach Bolt	—
4 [2]	Beam Splitter	74D111159
5	Guard	74A880682
6 [2]	Control/Display Unit	74D111141
7 [2]	Cable	74D111145-1001
8 [2]	Cable	74D111145-1003
9 [2]	Cable	74D111145-1005
10 [2]	Triaxial Detector Unit	74D111167
11 [1]	LDT Alignment Adapter	74D111108
12	Attach Bolt	—
13	Laser Clamp	—
14	Chain	—
15	Attach Bolt	—
16	Aft Upper Bolt	—
17	Forward Upper Bolt	—
18	Forward Lower Bolt	—
19	Chain	—
20	Aft Lower Bolt	—
21	Pitch Display	—
22	Switch	—
23	Yaw Display	—
24	Roll Display	—
25	Electrical Boresight Compensation Assy.	74A870612
26	LDT Thumbwheel Switch	—

Figure 1. LDT Mount (Sheet 6)

A1-F18AC-LMM-040

008 01

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INDEX NO.	NOMENCLATURE	PART NUMBER
LEGEND		
 1	Part of 74D110163 boresight alignment set.	
 2	Part of 74D110021 triaxial alignment set.	

Figure 1. LDT Mount (Sheet 7)

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****LASER DETECTOR TRACKER SYSTEM MOUNT****USING 537226 OPTICAL ALIGNMENT SET**

Reference Material

Line Maintenance Access Doors	A1-F18AC-LMM-010
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040
Plane Captain Manual.....	A1-F18AC-PCM-000
Communication, TACAN, ADF, Electronic Al-	
timeter and IFF Systems.....	A1-F18AC-600-300
Receiver-Transmitter	
RT-1250/ARC-182(V) (76A-F002)	WP003 00
Laser Detector Tracker System	A1-F18AC-743-300
Mounting Adapter MT-6082/ASQ-173	WP005 00
Weapon Control Systems	A1-F18AC-740-200
Electrical Boresight Compensation	
System Test.....	WP040 00
Weapon Control Systems	A1-F18AE-740-200
Electrical Boresight Compensation	
System Test.....	WP181 00
Navigation Infrared Receiving System	A1-F18AG-746-300
Mounting-Adapter MT-6512/AAR-50	WP003 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements	4
Aircraft Preparation.....	5
Alignment Verification Procedure	5
Introduction.....	2
General Instructions.....	3
Safety Precautions.....	3

Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
SEC 4998	—	Replacement of 74D110021 Triaxial Alignment Set With 537226 Optical Alignment Set. (Alameda ECP 775)	1 Jun 93	—

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for boresighting the laser detector tracker system (LDT) mount attach points located on lower right side of the center fuselage. Misalignment is corrected using the electrical boresight compensation assembly.

3. GENERAL INSTRUCTIONS. To make sure the mount is accurately boresighted, the instructions below shall be used:

- a. Due to equipment sensitivity, boresighting should only be done ashore.
- b. Personnel must be familiar with the use and operation of the optical alignment set.
- c. Personnel must know the principles of boresighting.
- d. Boresighting should be done separately from other maintenance operations.
- e. All mating surfaces on aircraft and boresight equipment must be clean with no visible damage.
- f. Visually inspect mating surfaces to make sure there are no obstructions that would prevent boresight equipment from making complete contact.
- g. Attach bolts shall be clean and free of burrs and damaged threads.
- h. Visually inspect for loose or missing sealant around nuts on equipment.
- i. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

4. SAFETY PRECAUTIONS.

5. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

6. AIRCRAFT BORESIGHT REQUIREMENTS.

7. Aircraft structural flexing affects LDT boresight accuracy. To control the effect of this flexing and to be sure the mount boresight is accurate, make sure the aircraft is as listed below:

a. Forward fuselage:

- (1) Make sure all armament, avionics electrical equipment, and/or ballast forward of the nose gear is installed.
- (2) Make sure ammunition drum is empty.
- (3) Make sure windshield is closed.
- (4) Make sure door 3 is closed (A1-F18AC-LMM-010).

b. Cockpit(s): Make sure no personnel, tools, and/or equipment are in cockpit.

c. Center and aft fuselage: Preferred configuration is engines installed and internal fuel cells full. However, two alternate configurations may be used: engines installed with aircraft defueled and engines removed with aircraft defueled. If alternate configuration is used, pitch compensation is required during boresighting.

d. External stores:

(1) Pylons, weapon launcher and/or ejector racks may be installed on all stations in any combination.

(2) Empty external fuel tanks and wing tip sidewinders may be installed.

(3) Forward looking infrared system may be installed.

8. AIRCRAFT PREPARATION.

- a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).
- b. Remove Mounting Adapter MT-6082/ASQ-173, if installed (A1-F18AC-743-300, WP005 00).
- c. Remove Mounting Adapter MT-6512/AAR-50, if installed (A1-F18AG-746-300, WP003 00).

9. ALIGNMENT VERIFICATION PROCEDURE. See figure 1.

Support Equipment Required

Part Number or Type Designation	Nomenclature
74D110163-1001	Boresight Alignment Set
537226	Optical Alignment Set
—	Torque Wrench, 0 to 200 Inch-Pounds

Materials Required**Specification
or Part Number****Nomenclature**

CCC-C-440 TYPE 1
CLASS 1
P-D-680, TYPE 2

Cheesecloth
Dry Cleaning Solvent

- a. Verify alignment of optical alignment set (WP010 02).
- b. Set up and install boresight reference frame assembly (BRFA) (1) (WP009 00).

WARNING

Dry cleaning solvent is flammable and toxic. Do not use near open flame or sparks. Avoid breathing vapors. Do not allow contact with skin or eyes. Use only in well ventilated areas.

- c. Clean attach points on LDT alignment adapter (11) and mating surfaces on fuselage using clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

- d. Visually inspect attach points to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- e. Make sure attach bolts are clean and free of burrs and damaged threads.
- f. Support LDT alignment adapter (11) on fuselage attach points and install four attach bolts (17, 18, 19, and 20) handtight in the sequence per substeps below:
 - (1) Forward lower bolt (18).
 - (2) Aft upper bolt (19).
 - (3) Forward upper bolt (17).
 - (4) Aft lower bolt (20).



Improper torquing of adapters can adversely affect the accuracy of boresight readings. Complying with the following torque sequences and torque values is critical.

- g. Torque four attach bolts (17, 18, 19, and 20) in the sequence and torque per substeps below:

- (1) Torque forward lower bolt (18) to 80 ± 10 inch-pounds.
- (2) Torque aft upper bolt (19) to 80 ± 10 inch-pounds.
- (3) Torque forward upper bolt (17) to 80 ± 10 inch-pounds.
- (4) Torque aft lower bolt (20) to 80 ± 10 inch-pounds.
- (5) Torque forward lower bolt (18) to 120 ± 10 inch-pounds.
- (6) Torque aft upper bolt (19) to 120 ± 10 inch-pounds.
- (7) Torque forward upper bolt (17) to 120 ± 10 inch-pounds.
- (8) Torque aft lower bolt (20) to 120 ± 10 inch-pounds.
- (9) Torque forward lower bolt (18) to 150 ± 10 inch-pounds.
- (10) Torque aft upper bolt (19) to 150 ± 10 inch-pounds.
- (11) Torque forward upper bolt (17) to 150 ± 10 inch-pounds.
- (12) Torque aft lower bolt (20) to 150 ± 10 inch-pounds.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- h. Clean attach points on optical reference measurement unit (2), target mirror assembly (10) and LDT alignment boxes (15) and (16) using clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch attach points. Oil residue from hands can affect alignment readings.

- i. Visually inspect attach points to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- j. Make sure attach bolts are clean and free of burrs and damaged threads.
- k. Lift optical reference measurement unit (2) by its carrying handle, hold against LDT alignment box (15) attach points.
- l. Engage and snug two upper attach bolts first, then the lower attach bolt.
- m. Hand tighten all three attach bolts (4) the same amount.

- n. Position optical target monitor (3) close to optical reference measurement unit (2) so video display (8) may be viewed while adjusting pitch and yaw micrometers (13) and (14).
- o. Connect cable (6) to optical target monitor (3) and optical reference measurement unit (2).
- p. Position target mirror assembly (10) on LDT alignment box (16) attach points.
- q. Engage and snug two upper attach bolts first, then the lower attach bolt.
- r. Hand tighten all three attach bolts (9) the same amount.
- s. Connect cable (7) to optical target monitor (3) and target mirror assembly (10).
- t. Connect power cable (5) to optical target monitor (3).
- u. Plug power cable (5) to electrical power source.
- v. Switch optical target monitor power switch (12) to ON.

NOTE

Do not adjust roll setting potentiometer (26).

- w. View video display (8) for crosshair position on target rings. If required, adjust pitch and yaw micrometers (13) and (14) by rotating pitch and yaw micrometer spindles (21) and (22) to get centering of crosshairs on target rings.

x. Read and record plus-minus PITCH (23), ROLL (24), and YAW (25) display indications from optical target monitor (3). Record indications to the nearest 0.5 milliradian. If alternate aircraft configuration is used, engines removed or aircraft defueled, compensate pitch indication per substeps below:

(1) Engines installed and aircraft defueled: Decrease pitch indication by 0.5 milliradian and record. Example: Pitch indication was -2.0 milliradians, a decrease of 0.5 milliradian causes indication to now be -2.5 milliradians.

(2) Engines removed and aircraft defueled: Increase pitch indication by 1.0 milliradian and record. Example: Pitch indication was -2.0 milliradians, an increase of 1.0 milliradian causes indication to now be -1.0 milliradian.

NOTE

Electrical boresight compensation assembly has a range from -7.5 to $+7.5$ milliradians.

y. If the LDT mount pitch, roll, and yaw indications are between -7.5 and $+7.5$ milliradians, the electrical boresight compensation assembly (27) shall be used to correct the misalignment. Go to next step. Indications below -7.5 or above $+7.5$ milliradians require a depot engineering disposition.

z. Open door 13R (A1-F18AC-LMM-010).

aa. Remove aft Receiver-Transmitter, RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).

ab. Read electrical boresight compensation assembly (27) LDT, plus-minus PITCH, ROLL, and YAW thumbwheel switches (28) settings. Switches are identified as LST.

ac. If LDT thumbwheel switches are the same as new boresight values, LDT mount is aligned correctly, go to step aj. If not the same, go to next step.

NOTE

Do not turn electrical boresight compensation assembly other system thumbwheel switches as it will cause the affected system to have the wrong boresight compensation data.

ad. Remove guard (29) from electrical boresight compensation assembly (27) by removing attach bolts (30).

ae. Input LDT mount plus-minus pitch, roll, and yaw milliradian indications into the electrical boresight compensation assembly plus-minus PITCH, ROLL, and YAW thumbwheel switches (28), marked LST.

af. Record new thumbwheel switch (28) settings on Miscellaneous History Card OPNAV 4790/25A, part of the Aircraft Log Book.

NOTE

Setting GUN-MC thumbwheel switch is a factory adjustment and should not be changed.

- ag. Verify GUN-MC thumbwheel switch on electrical boresight compensation assembly (27) is set on +2.0 for 161353 THRU 161987 or +2.5 for 162394 AND UP.
- ah. Do electrical boresight compensation system test (A1-F18AC-740-200, WP040 00 or A1-F18AE-740-200, WP181 00).
- ai. Install guard (29) with attach bolts (30).
- aj. Install aft Receiver-Transmitter RT-1250/ARC-182(V) (76A-F002) (A1-F18AC-600-300, WP003 00).
- ak. Inspect door 13R for foreign objects.
- al. Close door 13R (A1-F18AC-LMM-010).
- am. Switch optical target monitor power switch (12) to OFF.
- an. Unplug power cable (5) from electrical power source.
- ao. Disconnect power cable (5) from optical target monitor (3).
- ap. Disconnect cable (7) from optical target monitor (3) and target mirror assembly (10).
- aq. Disconnect cable (6) from optical target monitor (3) and optical reference measurement unit (2).
- ar. Remove target mirror assembly (10) from LDT alignment box (16).

- as. Remove optical reference measurement unit (2) from LDT alignment box (15).
- at. Remove LDT alignment adapter (11) from fuselage attach points by removing four attach bolts (17, 18, 19, and 20).
- au. Replace all boresighting equipment to proper storage areas.
- av. If all boresighting is completed, remove and stow BRFA (1) (WP009 00).
- aw. If all boresighting is completed, remove safety devices, as required (A1-F18AC-PCM-000).

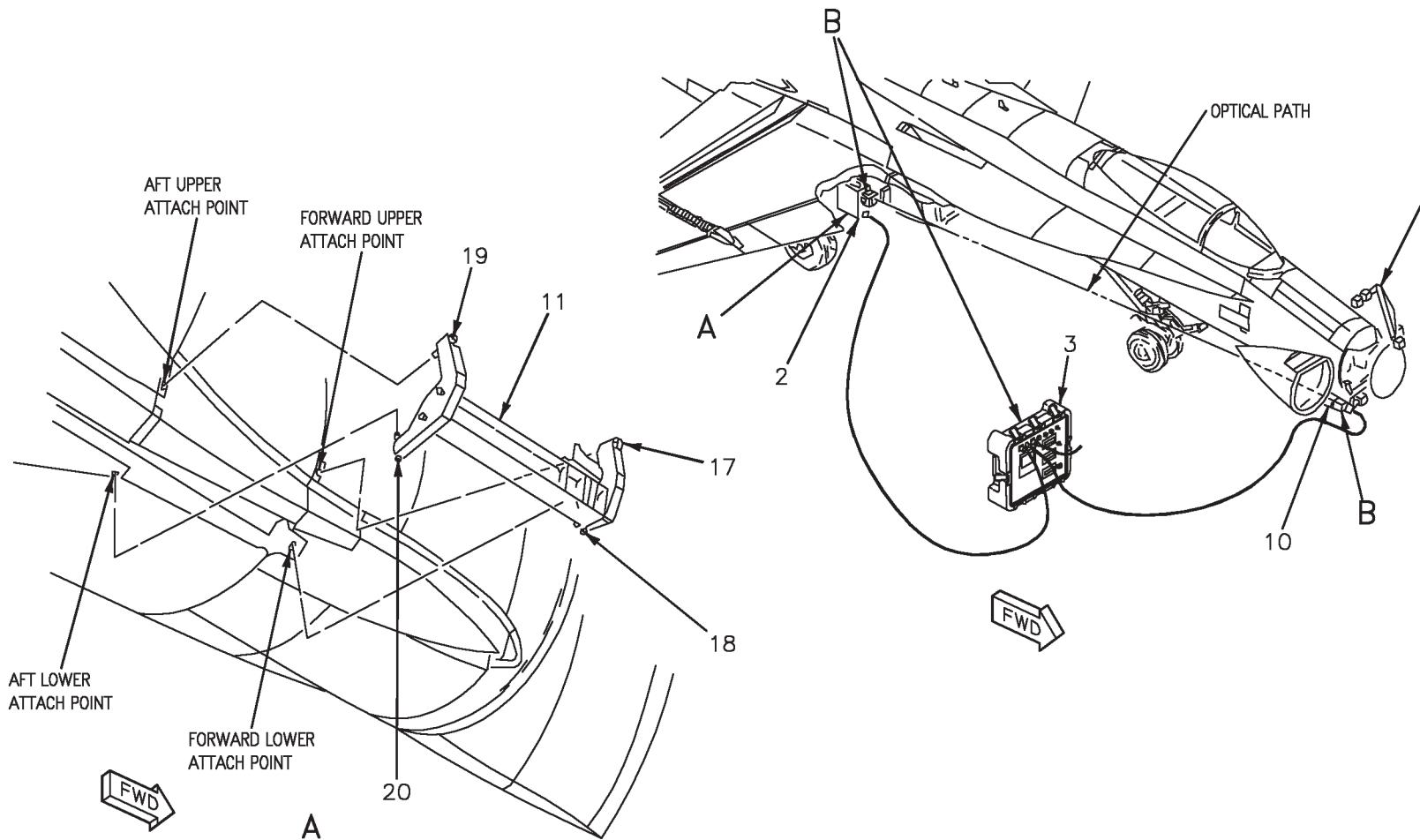


Figure 1. LDT Mount (Sheet 1)

Figure 1.

18AC-LMM-04-(13-1)11-SCAN

Figure 1.

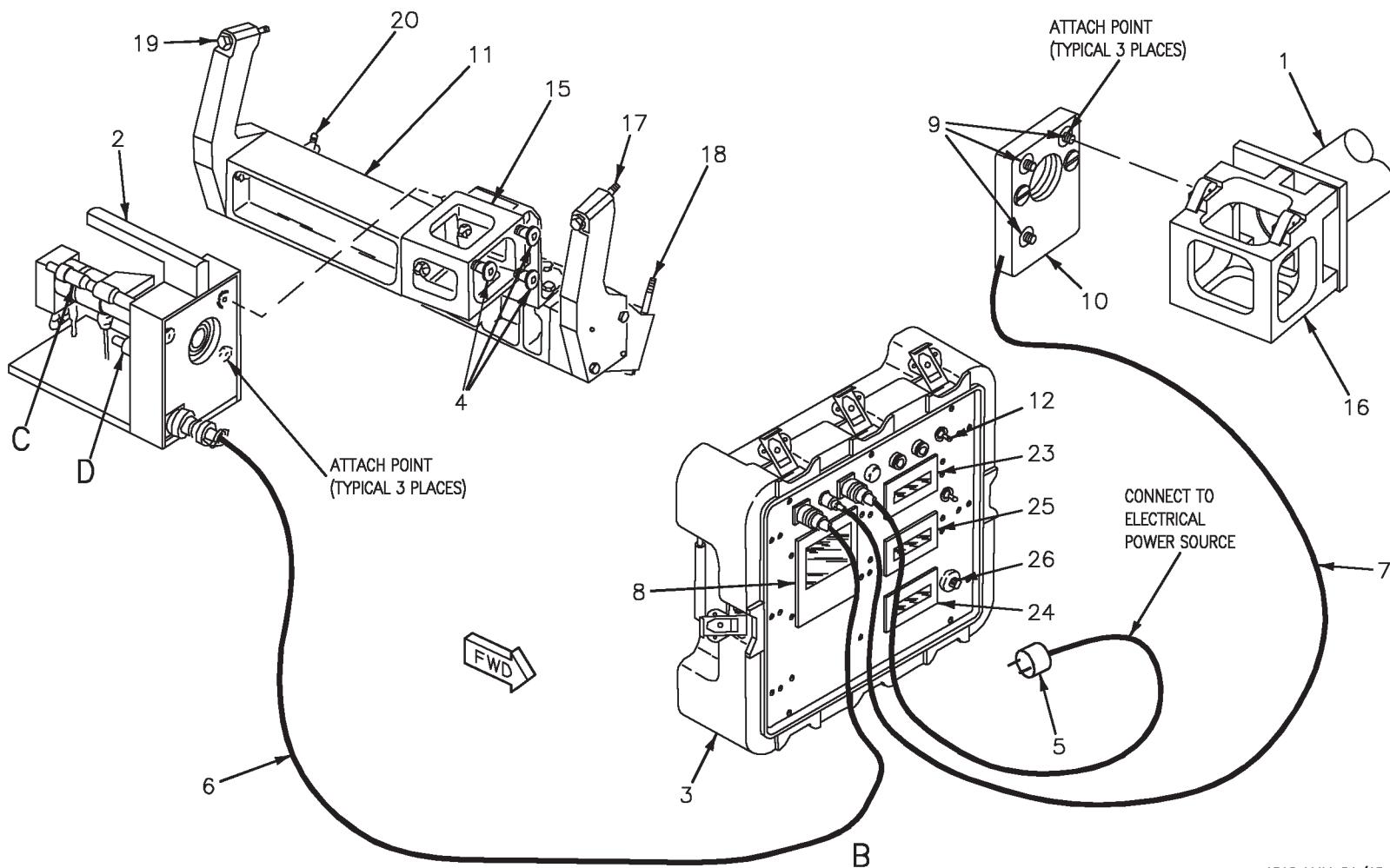
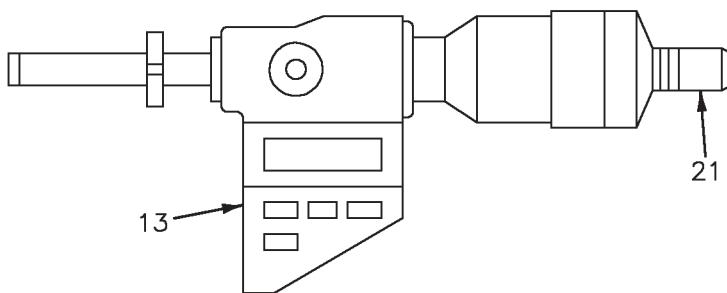
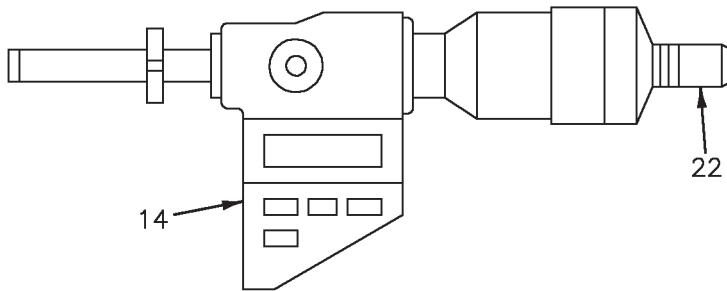


Figure 1. LDT Mount (Sheet 2)

18AC-LMM-04-(13-2)11-SCAN



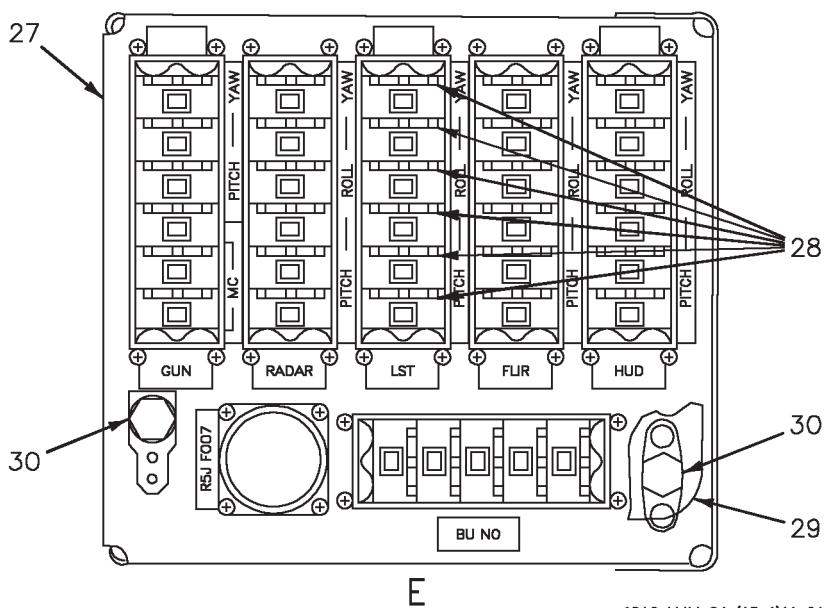
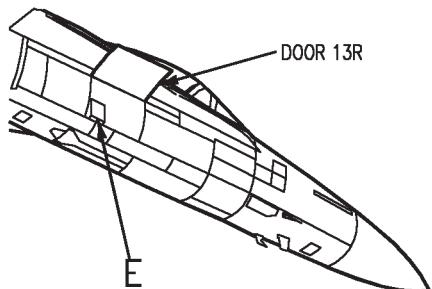
**PITCH MICROMETER
C**



**YAW MICROMETER
D**

18AC-LMM-04-(13-3)11-CATI

Figure 1. LDT Mount (Sheet 3)

**Figure 1. LDT Mount (Sheet 4)**

18AC-LMM-04-(13-4)11-CATI

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1] ◀	Boresight Reference Frame Assembly	74D111115
2 [2] ◀	Optical Reference Measurement Unit	537227
3 [2] ◀	Optical Target Monitor	437228
4	Attach Bolts	—
5 [2] ◀	Power Cable	437230-1
6 [2] ◀	Cable	437230-2
7 [2] ◀	Cable	437230-3
8	Video Display	—
9	Attach Bolts	—
10 [2] ◀	Target Mirror Assembly	437232
11 [1] ◀	LDT Alignment Adapter	74D111108
12	Power Switch	—
13	Micrometer, Pitch	—
14	Micrometer, Yaw	—
15	LDT Alignment Box	—
16	LDT Alignment Box (BRFA)	—
17	Forward Upper Bolt	—
18	Forward Lower Bolt	—
19	Aft Upper Bolt	—
20	Aft Lower Bolt	—
21	Micrometer Spindle, Pitch	—
22	Micrometer Spindle, Yaw	—
23	Digital Display, Pitch	—
24	Digital Display, Roll	—
25	Digital Display, Yaw	—
26	Roll-Adjust Zero Potentiometer	—

Figure 1. LDT Mount (Sheet 5)

INDEX NO.	NOMENCLATURE	PART NUMBER
27	Electrical Boresight Compensation Assy.	74A870612
28	LDT Thumbwheel Switch	—
29	Guard	74A880682
30	Attach Bolt	—

LEGEND

[1] Part of 74D110163 boresight alignment set.
[2] Part of 537226 optical alignment set.

Figure 1. LDT Mount (Sheet 6)

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****BORESIGHT REFERENCE FRAME ASSEMBLY**

Reference Material

Line Maintenance Access Doors	A1-F18AC-LMM-010
Airborne Weapons/Stores Loading	A1-F18AC-LWS-000
Guns	Section 28
Airborne Weapons/Stores Loading	A1-F18AE-LWS-000
Guns	Section 29
Plane Captain Manual	A1-F18AC-PCM-000
Radar System	A1-F18AC-742-300
Extension and Stowage of Radar Set	
AN/APG-65	WP003 00
Radar System	A1-F18AH-742-300
Extension and Stowage of Radar Set	
AN/APG-73	WP003 00

Alphabetical Index

Subject	Page No.
Aircraft Boresight Requirements When All WRA Mounts Are Being Boresighted	4
Aircraft Preparation.....	4A
Installation Procedure	5
Introduction.....	3
Removal and Stowage Procedure	9
Setup Procedure	4A

Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
SEC 4998	—	Replacement of 74D110021 Triaxial Alignment Set With 537226 Optical Alignment Set. (Alameda ECP 775)	1 Jun 93	—

Support Equipment Required**Part Number or
Type Designation** **Nomenclature**

74D740001-1001	Antenna Cover
74D110163-1001	Boresight Alignment Set

Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
—	Torque Wrench, 0 to 200 Inch-Pounds
—	Torque Wrench, 700 to 1600 Inch-Pounds

Materials Required

Specification or Part Number	Nomenclature
CCC-C-440 TYPE 1 CLASS 1	Cheesecloth, Cloth
P-D-680, TYPE 2	Dry Cleaning Solvent
AN960JD516L	Washer (As Reqd)

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for setup, installation, and removal of the boresight reference frame assembly (BRFA). This procedure is used for installing the BRFA on the radar bulkhead to establish a boresight target point for the optical alignment set or the triaxial alignment set. This procedure also gives instructions on aircraft boresight requirements when all WRA mounts require boresighting.

2A. AIRCRAFT BORESIGHT REQUIREMENTS WHEN ALL WRA MOUNTS ARE BEING BORESIGHTED.**NOTE**

If only one individual WRA mount is being boresighted, refer to that specific work package for aircraft boresight requirements.

- a. Armament, avionics, electrical equipment and/or ballast must be installed.
- b. Ammunition drum must be empty and gun system unloaded (A1-F18AC-LWS-000, Section 28 or A1-F18AE-LWS-000, Section 29).
- c. Windshield must be closed.
- d. Door 3 must be closed (A1-F18AC-LMM-010).
- e. No personnel, tools and/or loose equipment is allowed in cockpit.
- f. Pylons, weapon launchers and/or ejector racks may be installed on all stations and in any combination.
- g. Empty external fuel tanks and wing tip sidewinders may be installed.
- h. All weapons must be removed except for wing tip sidewinders.
- i. Engines installed and internal fuel tanks full is the preferred configuration. However, two alternate configurations may be used: engines installed with aircraft defueled and engines removed and aircraft defueled. If alternate configuration is used, pitch compensation is required during boresighting of the FLIR and LDT.

j. When planning the sequence of WRA mounts to be boresighted, the INU and HUD should be done together because roll alignment is done differently on remaining WRA mounts.

3. AIRCRAFT PREPARATION.

a. Make sure ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

b. Make sure door 3 is closed (A1-F18AC-LMM-010).

4. SETUP PROCEDURE. See figure 1.



To avoid possible damage to BRFA, do not use boxes as hand holds when handling BRFA.

a. Remove 74D111115 BRFA (1) from storage case.

b. Set BRFA (1) on the two rubber pads.

c. Prepare BRFA (1) per substeps below:

(1) Remove two L-pins (4) securing BRFA in folded position.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- (2) Inspect hinge area for excess dirt. If required, separate hinge half and clean using cheesecloth moistened with solvent.
- (3) Inspect hinge area for galled surfaces. Surface area showing signs of galling require an depot engineering disposition.
- (4) Unfold BRFA.

(5) Remove two tapered pins (2) from stowed position and install in hinge. Do not use hand tools on tapered pins.

(6) Initially torque nuts on tapered pins (2) to 80 ± 5 inch-pounds. Continue torquing nuts sequentially in 10 inch-pound increments to 120 ± 5 inch-pounds. Do not use hand tools on tapered pins.

(7) Torque hinge pivot bolt (3) to 1000 ± 50 inch-pounds.

(8) Retorque nuts on tapered pins (2) to 120 ± 5 inch-pounds. Do not use hand tools on tapered pins.

5. INSTALLATION PROCEDURE. See figure 2.

- a. Open radome (A1-F18AC-LMM-010).
- b. Install antenna cover (7) on antenna.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- c. Clean all mating surfaces of BRFA (1) and aircraft attach points by wiping with cheesecloth moistened with solvent. Make sure three attach bolts (2, 3, and 4) are clean and free of burrs and damaged threads. Make sure attach point plate nut threads on bulkhead are clean and free of grease and foreign objects.

NOTE

After cleaning, do not touch mating surfaces. Oil residue on hands can affect alignment readings.

d. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.

e. Make sure Radar Set is stowed (A1-F18AC-742-300, WP003 00 or A1-F18AH-742-300, WP003 00). |



Failure to compensate for repair doubler interference with BRFA will cause boresight error. Use minimum number of washers required to clear repair doubler.

NOTE

Repair doubler may exist on aircraft 161353 THRU 161987. It is approximately 10 inches long and installed on lower right side of bulkhead in place of machined bosses around alignment pin and radome latch striker. |

f. On aircraft 161353 THRU 161987, inspect radar bulkhead for a repair doubler located on the forward right side near BRFA attach point. If doubler is installed, do substeps below: |

(1) Install one AN960JD516L washer on each BRFA attach bolt (2, 3, and 4) between BRFA and bulkhead. |

(2) Install BRFA per step g, and inspect to make sure BRFA is flush against washers and clear of repair doubler.

(3) If required, remove BRFA and install additional equal number of AN960JD516L washers on each attach bolt to clear repair doubler.

g. Install BRFA (1) on aircraft per substeps below:

WARNING

BRFA weighs approximately 75 pounds and can be unstable when being raised to its installation height. Be careful when installing BRFA to avoid personal injury and/or damage to radar antenna planar array.

Do not lift BRFA by the triaxial alignment boxes. Lift only at the main structure or damage to BRFA may occur.

(1) Lift BRFA up, slide it on two alignment pins (5 and 6), and hold in position. Install upper attach bolt (4) handtight, then install two lower attach bolts (2 and 3) handtight.

(2) Check mating of BRFA attaching points with aircraft attaching points to make sure that BRFA is not warped or damaged.



Improper torquing of adapters can adversely affect the accuracy of boresight readings. Complying with the following torque sequences and torque values is critical.

(3) Torque three attach bolts (2, 3, and 4) in the sequence and torque per substeps below:

- (a) Torque lower left bolt (2) to 90 ± 5 inch-pounds.
- (b) Torque lower right bolt (3) to 90 ± 5 inch-pounds.
- (c) Torque upper left bolt (4) to 90 ± 5 inch-pounds.
- (d) Torque lower left bolt (2) to 105 ± 5 inch-pounds.
- (e) Torque lower right bolt (3) to 105 ± 5 inch-pounds.
- (f) Torque upper left bolt (4) to 105 ± 5 inch-pounds.
- (g) Torque lower left bolt (2) to 120 ± 5 inch-pounds.
- (h) Torque lower right bolt (3) to 120 ± 5 inch-pounds.
- (i) Torque upper left bolt (4) to 120 ± 5 inch-pounds.

6. REMOVAL AND STOWAGE PROCEDURE. See figure 3.**WARNING**

BRFA weighs approximately 75 pounds and can be unstable when being removed from aircraft. Be careful when removing BRFA to avoid personal injury and/or damage to radar antenna planar array.

Do not lift BRFA by the triaxial alignment boxes. Lift only at the main structure, or damage to BRFA may occur.

- a. Hold BRFA (1) in position and remove two lower attach bolts (2 and 3) then remove upper attach bolt (4). Being careful, slide BRFA off of two alignment pins (5 and 6) and set on the two rubber pads.
- b. Remove washers, if installed per paragraph 5.
- c. Stow BRFA (1) per substeps below:
 - (1) Remove two tapered pins (8), using the tapered pin nuts as extractors, and put in stowed position. Do not use hand tools on tapered pins.

WARNING

Upper half of BRFA will fold down when hinge pivot bolt is loosened. Guide upper half down carefully to avoid personal injury or damage to BRFA.

To prevent damage to hinge pivot bolt, loosen a maximum of one-half turn.

(2) Loosen hinge pivot bolt (7) one-half turn.

(3) Fold BRFA and install two L-pins (9).

(4) Put BRFA in storage case.

d. Inspect radome area for foreign objects.

e. Remove antenna cover (10).

f. Close radome (A1-F18AC-LMM-010).

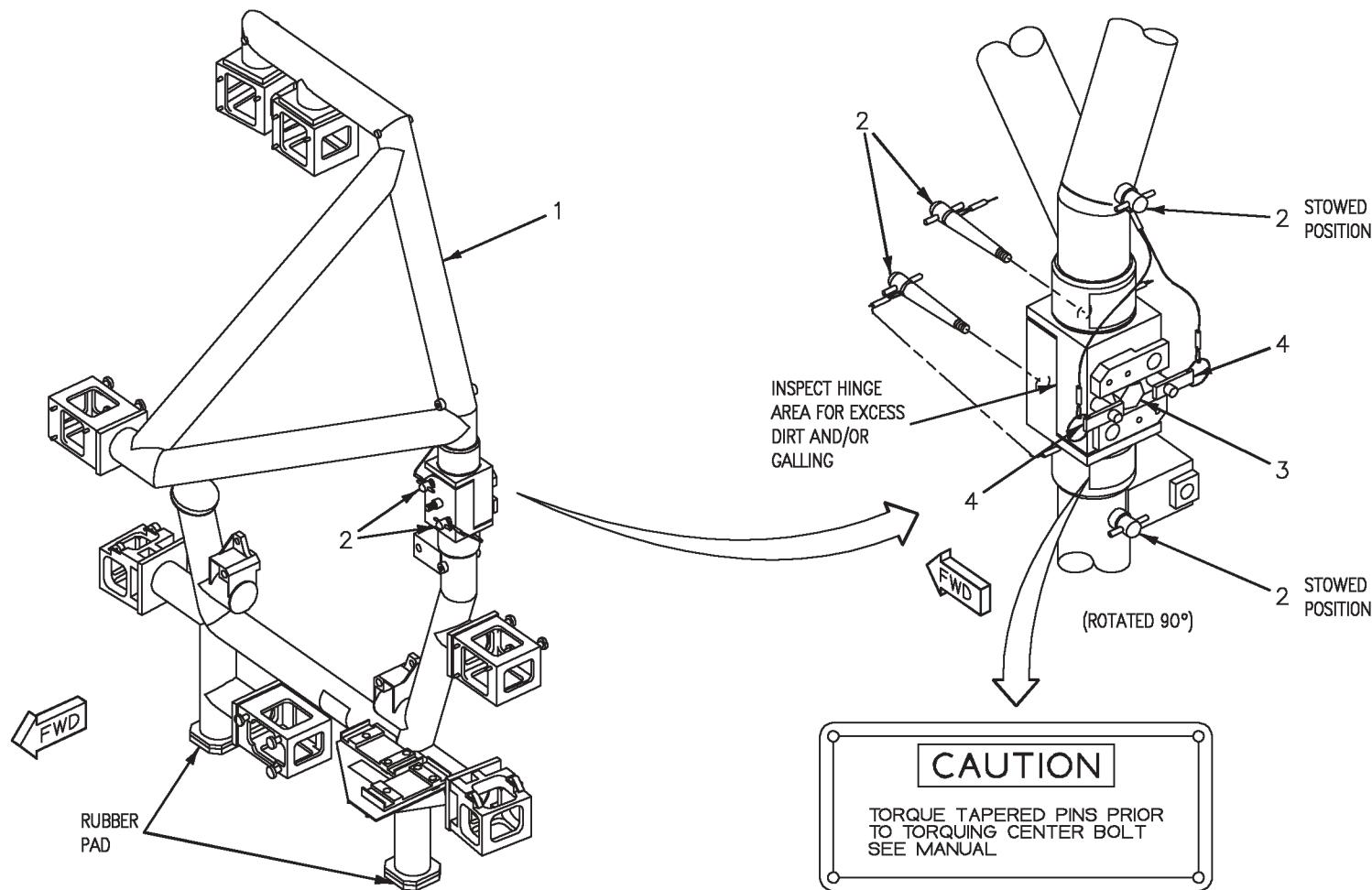


Figure 1. BRFA, Setup (Sheet 1)

Figure 1.

Figure 1.

INDEX NO.	NOMENCLATURE	PART NUMBER
1 	Boresight Reference Frame Assembly	74D111115
2	Tapered Pin	—
3	Hinge Pivot Bolt, 1-1/8 Inch	—
4	L-Pin	—

LEGEND

 Part of 74D110163 boresight alignment set.

Figure 1. BRFA, Setup (Sheet 2)

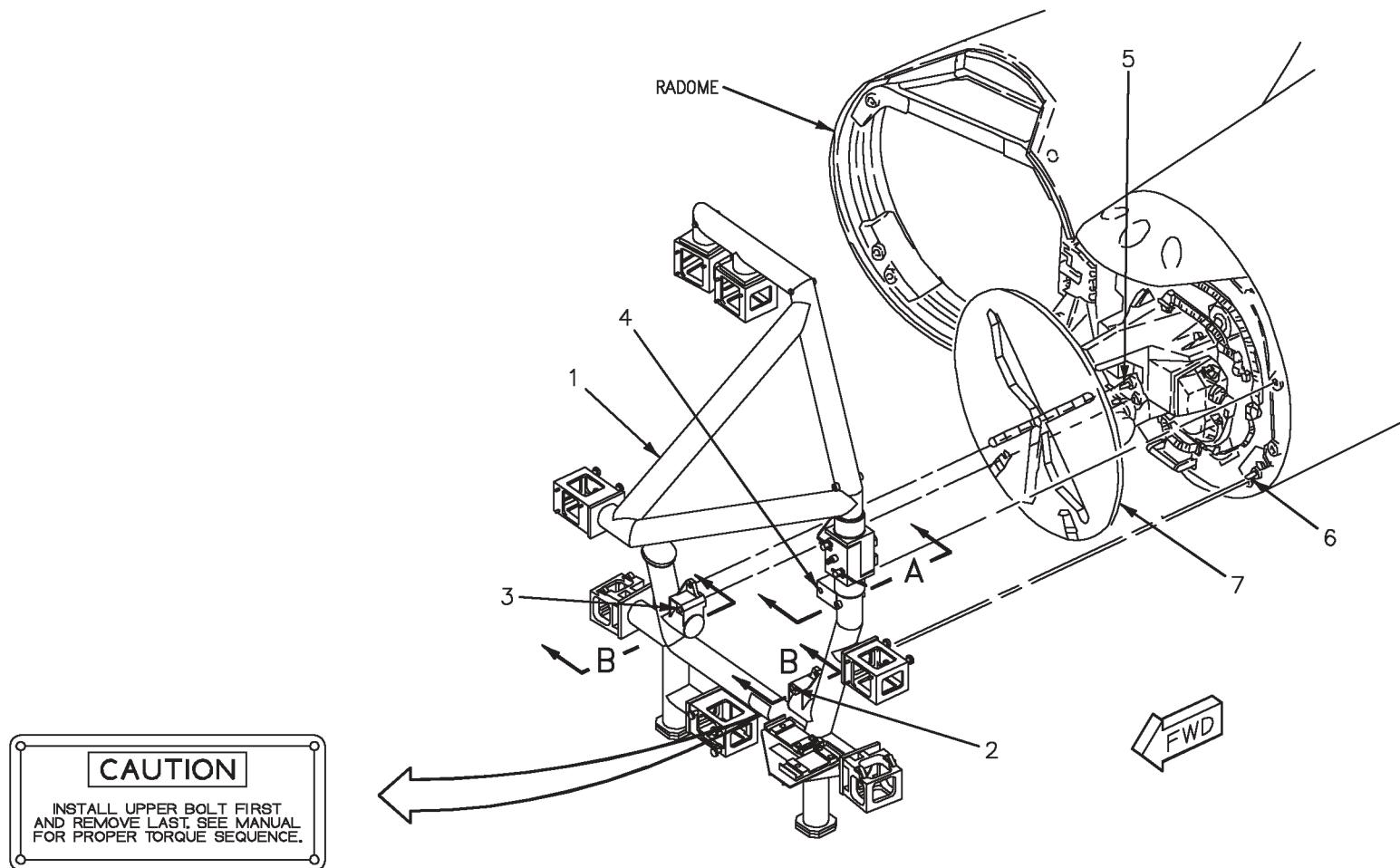
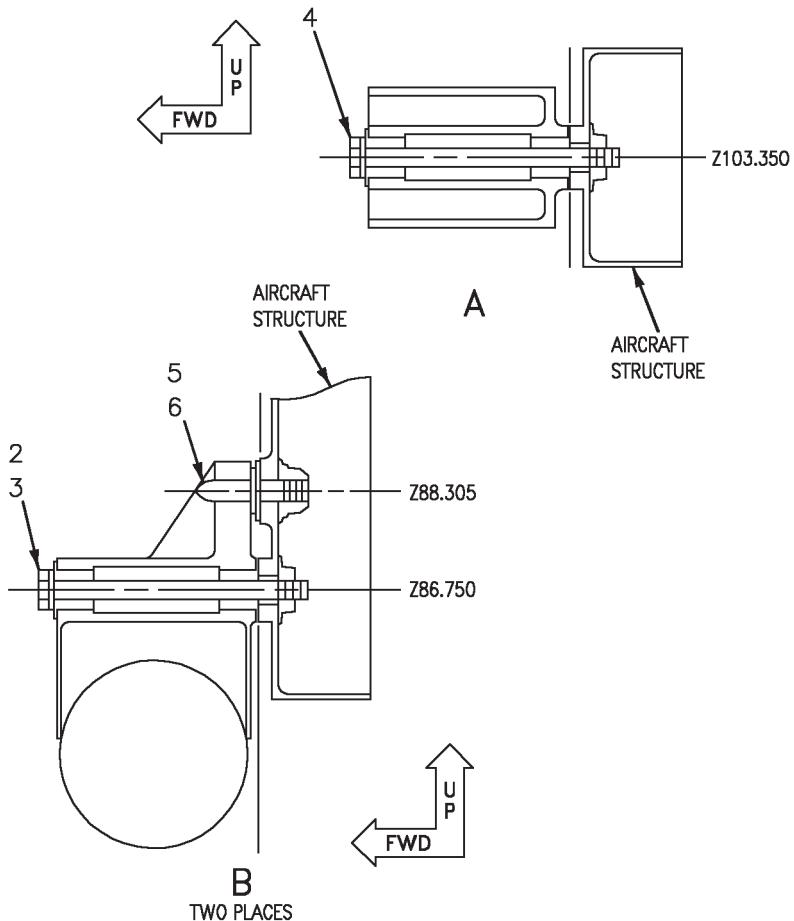


Figure 2. BRFA, Installation (Sheet 1)

Figure 2.

18AC-LMM-04-(3-1)11-SCAN

Figure 2.



INDEX NO.	NOMENCLATURE	PART NUMBER
1 	Boresight Reference Frame Assembly	74D111115
2	Attach Bolt	—
3	Attach Bolt	—
4	Attach Bolt	—
5	Alignment Pin	—
6	Alignment Pin	—
7	Antenna Cover	74D740001-1001

LEGEND

 Part of 74D110163 boresight alignment set.

Figure 2. BRFA, Installation (Sheet 3)

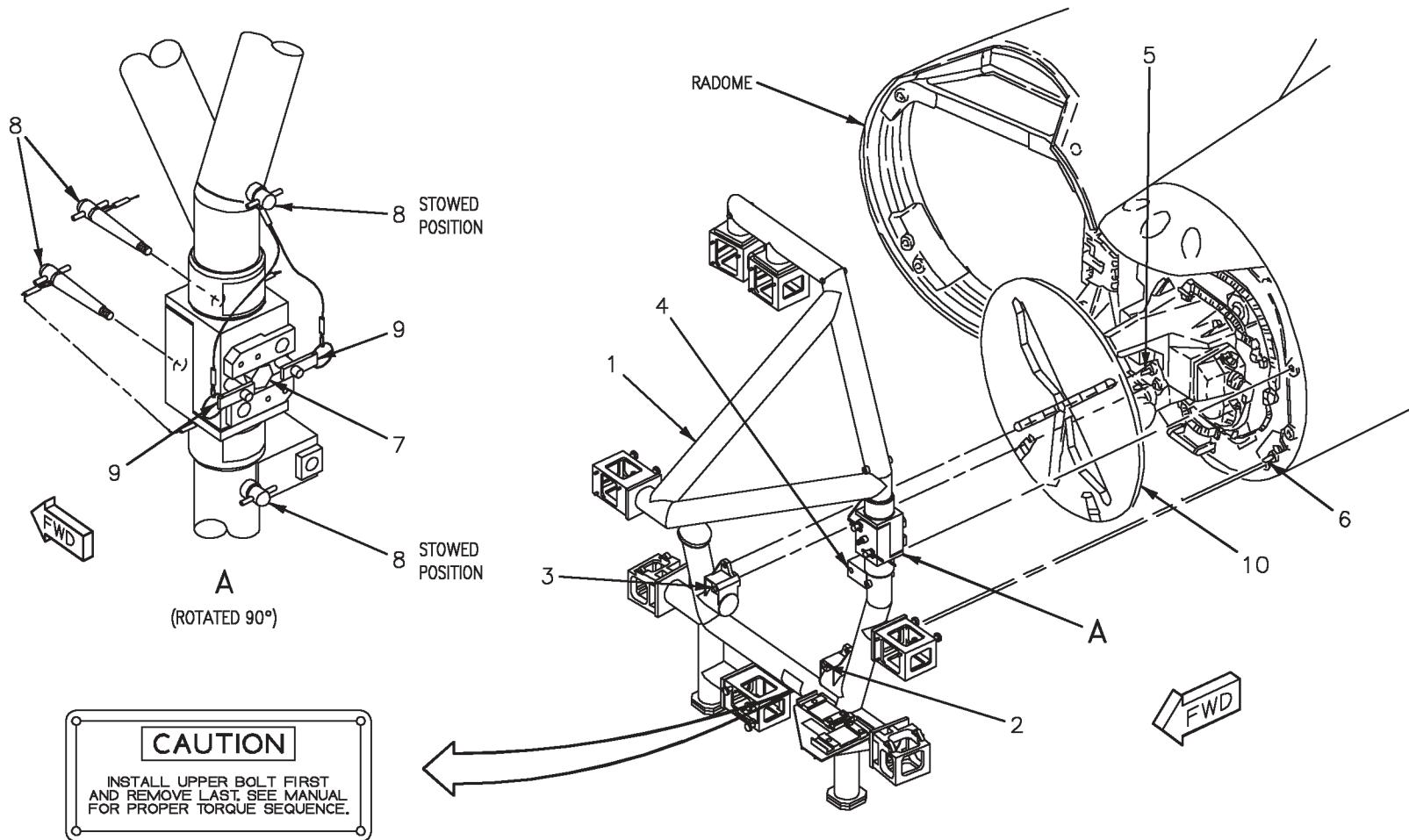


Figure 3. BRFA, Removal and Stowage (Sheet 1)

Figure 3.

Figure 3.

INDEX NO.	NOMENCLATURE	PART NUMBER
1 	Boresight Reference Frame Assembly	74D111115
2	Attach Bolt	—
3	Attach Bolt	—
4	Attach Bolt	—
5	Alignment Pin	—
6	Alignment Pin	—
7	Hinge Pivot Bolt	—
8	Tapered Pin	—
9	L-Pin	—
10	Antenna Cover	74D740001-1001

LEGEND

 Part of 74D110163 boresight alignment set.

Figure 3. BRFA, Removal and Stowage (Sheet 2)

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****ALIGNMENT SET VERIFICATION PROCEDURE**

Title	WP Number
Alignment Set Verification Procedure	
Using 74D110021 Triaxial Alignment Set	010 01
Using 537226 Optical Alignment Set	010 02

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****ALIGNMENT SET VERIFICATION PROCEDURE****USING 74D110021 TRIAXIAL ALIGNMENT SET**

Reference Material

None

Alphabetical Index

Subject	Page No.
Alignment Verification Procedure	3
Cleaning Optical Surfaces	9
Equipment Stowage	8
Introduction.....	2

Record of Applicable Technical Directives

None

Support Equipment Required

Part Number or Type Designation	Nomenclature
74D110163-1001 (74D110159-1001)	Boresight Alignment Set (Triaxial Alignment Set Check Fixture)
74D110021-1003 (74D110021-1001)	Triaxial Alignment Set
—	Camel Hair Brush

Materials Required

Specification or Part Number	Nomenclature
MIR-O-LEN	Cleaning, Solution
—	Tissue, Lens
CCC-C-440 TYPE 1 CLASS 1	Cheesecloth
P-D-680, TYPE 2	Dry Cleaning Solvent

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for verifying the alignment of 74D110021 triaxial alignment set using triaxial alignment set check fixture (check fixture). If more than one system is to be boresighted, the triaxial alignment set should be installed on the check fixture between procedures with equipment turned on. This will keep equipment at a constant operating temperature and

help prevent accidental damage or misplaced equipment. This WP also contains instructions for cleaning the precision optical surfaces.

3. ALIGNMENT VERIFICATION PROCEDURE. See figure 1.



CAUTION

To prevent damage to optical surfaces, clean only when necessary. Minimize cleaning by proper storage when not in use and careful handling when using the equipment.

- a. Clean optical surfaces only if required to remove accumulated dust, fingerprints, oil, or water spots. See CLEANING OPTICAL SURFACES, this WP.

NOTE

Avoid touching optical surfaces with bare hands.



WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- b. Clean all mating surfaces of check fixture (2), triaxial detector unit (TDU) (1), and beam splitter (3) by wiping with clean cheesecloth moistened with dry cleaning solvent.

NOTE

After cleaning, do not touch mating surfaces. Oil residue from hands can affect alignment readings

- c. Visually inspect mating surfaces to make sure there is no visible damage or obstructions that would prevent complete contact of mating surfaces.
- d. Lift the TDU (1) by its carrying handle, hold against check fixture attach bushings, engage and snug two upper attach bolts first, then the lower attach bolt.
- e. Hand tighten all three attach bolts (11) for TDU (1) the same amount.
- f. Lift beam splitter (3) by the box frame near the top, hold against check fixture attach bushings, engage and snug two upper attach bolts first, then the lower attach bolt.
- g. Hand tighten all three attach bolts (9) for the beam splitter (3) the same amount.
- h. Install laser (4) in check fixture (2) per substeps below:

- (1) Wipe all oil and fingerprints from the steel tube using clean cheesecloth.
- (2) Open two laser clamps (10).

(3) Carefully place laser (4) over cone bolts with lines on decal aligned to the back of the box and to index mark on check fixture (2).

(4) Close laser clamps (10) to hold in place.

NOTE

Misalignment of lines can degrade boresight accuracy.

(5) Verify that lines on laser decal are still aligned with check fixture (2).

i. Position control/display unit (CDU) (8) near check fixture (2).

j. Route 74D11145-1001 cable (7) straight through check fixture (2) from end opposite TDU (1). Avoid any sharp bends which could deflect the TDU.

k. Connect cable (7) to TDU (1).

l. Connect opposite end of cable (7) to CDU (8).

m. Connect cable on laser (4) to CDU (8).

WARNING

To avoid electrical shock hazard, be sure to properly ground equipment to prevent personnel injury or damage to equipment.

n. Connect 74D11145-1003 cable (5), with ground wire, to CDU (8) and to 74D11145-1005 cable (6).

NOTE

If aircraft utility power is to be used, cable (6) is not needed.

- o. Plug in cable (6) to electrical power source.

WARNING

Laser radiation, do not look into laser beams or eye injury could occur.

NOTE

The main laser light will illuminate when CDU (8) is turned on. When laser energy is not sensed by the TDU after approximately 15 seconds, it will inhibit the laser, causing the main laser light to go off.

- p. Make sure all circuit breakers are ON, if applicable, then press CDU power switch (13) to 0N position.
- q. Verify the following indications.
 - (1) Power switch (13) pushbutton illuminates.
 - (2) POWER lamp illuminates.
 - (3) MAIN LASER lamp illuminates.
 - (4) Numeric values are displayed in display windows.

r. If any of the above indications fail to occur, do the following.

(1) Check fuses or circuit breakers, as applicable.

(2) Press the LAMP TEST pushbutton to make sure all indicators illuminate.

(3) Recycle power and check for presence of laser beam within 10 seconds.

(4) Check cable connections and then flex cables at connections while watching CDU indications.

s. If all indications are present, allow 30 minutes for equipment warmup.

NOTE

Normal equipment operation will allow the displayed ROLL reading to fluctuate as much as ± 0.50 milliradians about a median value. Operator judgement should be used to determine this median roll value.

t. Read and record PITCH (16), ROLL (15), and YAW (14) display indications on CDU (8).

u. If pitch and yaw indications recorded in step t are 0.00 ± 0.50 milliradian and roll is 0.00 ± 1.00 milliradian, the triaxial alignment set is within tolerance. If within tolerance, go to next step. If not within tolerance, the triaxial alignment set must be recalibrated at depot maintenance before using to boresight.

- v. Leave equipment operating in check fixture while preparing for installation on aircraft.
- w. Do applicable boresight procedure.

4. EQUIPMENT STOWAGE.

- a. Press CDU (8) power switch (13) to off position.
- b. Unplug cable (6) from electrical power source, if external power was used.
- c. Disconnect cable (5), and ground wire, from CDU (8) and cable (6).
- d. Disconnect laser cable from CDU (8).
- e. Disconnect cable (7) from CDU (8) and TDU (1).
- f. Remove laser (4) from check fixture (2) per substeps below:
 - (1) Open two laser clamps (10).
 - (2) Slide laser (4)out of check fixture (2).
 - (3) Close two laser clamps (10).
- g. Remove beam splitter (3) from check fixture (2) by loosening three attach bolts (9).
- h. Remove TDU (1) from check fixture (2) by loosening three attach bolts (11).
- i. Stow all equipment in equipment box.

5. CLEANING OPTICAL SURFACES.**CAUTION**

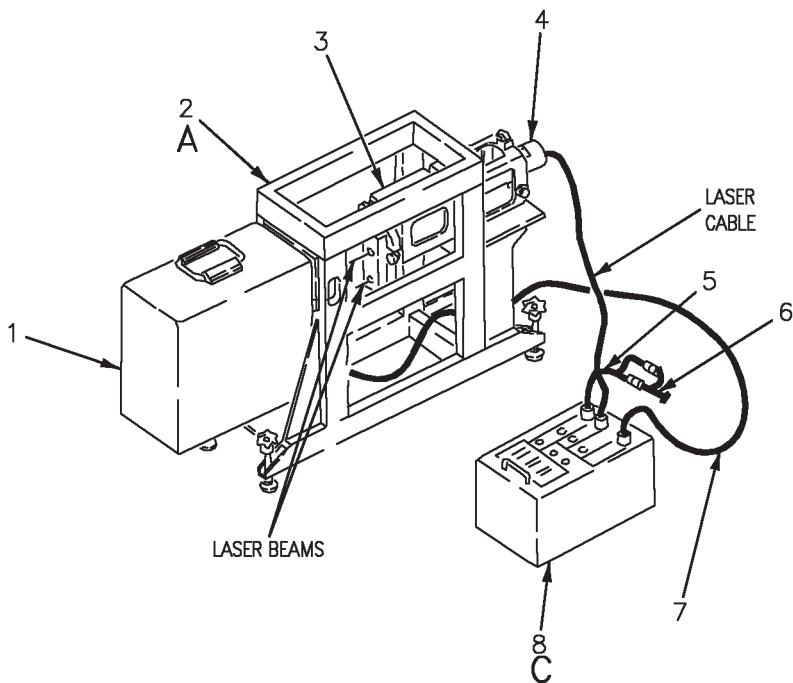
Optical surfaces must never be wiped with a dry lens tissue or cheesecloth. Damage to optical surface will result.

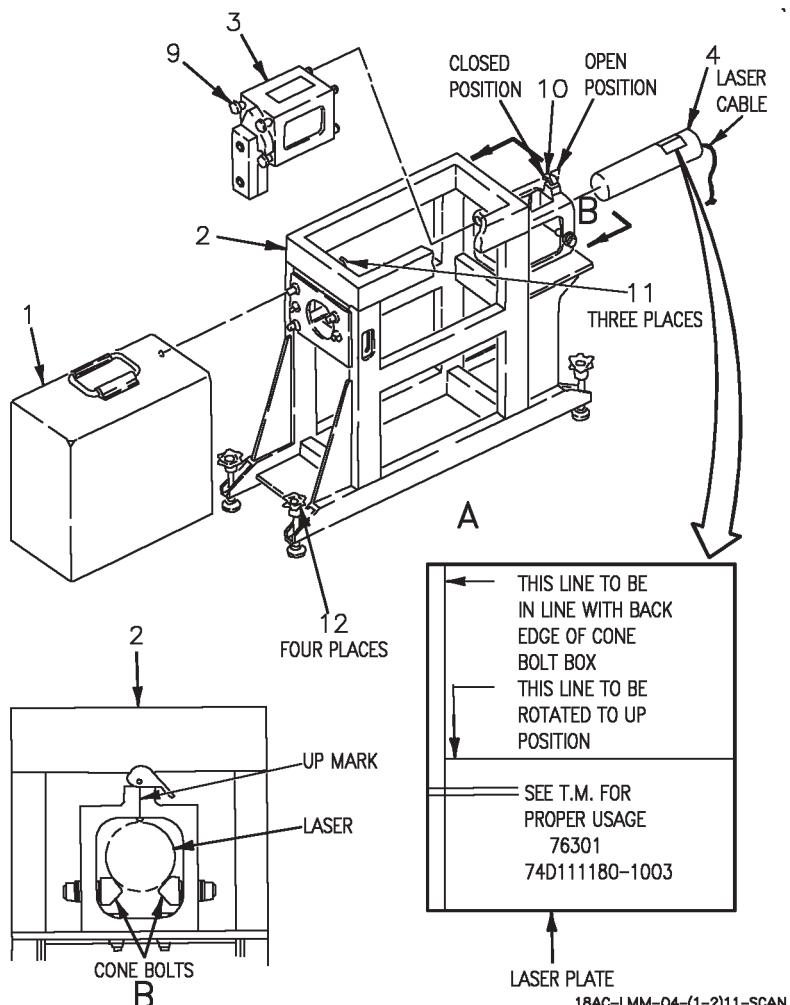
6. Optical surfaces on boresight equipment should only be cleaned only when required to remove accumulated dust, fingerprints, oil, or water spots. Proper storage when not in use and careful handling during use helps minimize the need for cleaning too often, which does create the potential for damage.

a. Remove dust by blowing with compressed dry nitrogen or Freon. A lens brush may be used, but it must be kept clean. Remaining dust should be removed with lens tissue moistened with cleaning solution and gently wiping in one direction.

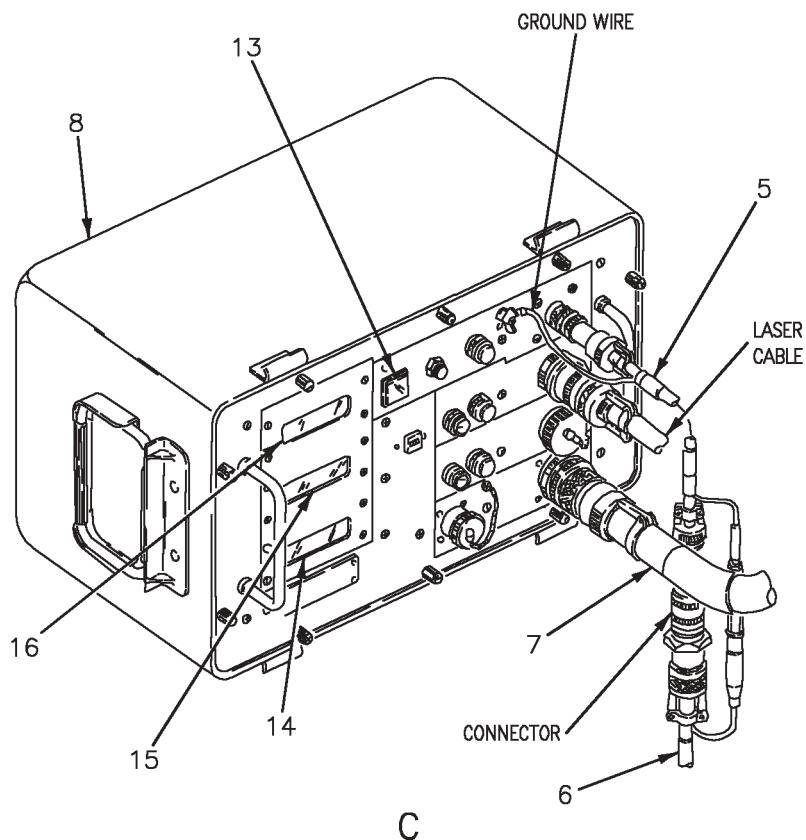
b. Fingerprints, or other oily substances, should be cleaned immediately with lens tissue moistened with cleaning solution. As an alternate for cleaning solution; make a mixture of 1 part mild neutral soap with 99 parts water, moisten a lens tissue, wipe in one direction, rinse with distilled water, and final clean with alcohol.

c. To speed drying time and minimize streaking, the lens may be wiped with an acetone wetted lens tissue following the use of cleaning solution or alcohol. Use acetone sparingly so as not to damage gaskets under lens retaining ring.

**Figure 1. Triaxial Alignment Set Check Fixture
(Sheet 1)**



**Figure 1. Triaxial Alignment Set Check Fixture
(Sheet 2)**



18AC-LMM-04-(1-3)11-SCAN

**Figure 1. Triaxial Alignment Set Check Fixture
(Sheet 3)**

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]	Triaxial Detector Unit (TDU)	74D111167
2 [2]	Check Fixture	74D111195
3 [1]	Beam Splitter	74D111159
4 [1]	Laser	74D111180
5 [1]	Cable	74D111145-1003
6 [1]	Cable	74D111145-1005
7 [1]	Cable	74D111145-1001
8 [1]	Control/Display Unit (CDU)	74D111141
9	Attach Bolt	—
10	Laser Clamp	—
11	Attach Bolt	—
12	Leveling Foot	—
13	Power Switch	—
14	Yaw Display	—
15	Roll Display	—
16	Pitch Display	—

LEGEND

[1] Part of 74D110021 triaxial alignment set.

[2] Part of 74D110159 triaxial alignment set check fixture or
74D110163 boresight alignment set.

**Figure 1. Triaxial Alignment Set Check Fixture
(Sheet 4)**

ORGANIZATIONAL MAINTENANCE**LINE MAINTENANCE BORESIGHTING DATA****ALIGNMENT SET VERIFICATION PROCEDURE****USING 537226 OPTICAL ALIGNMENT SET**

Reference Material

Plane Captain Manual.....	A1-F18AC-PCM-000
Line Maintenance Boresighting Data.....	A1-F18AC-LMM-040

Alphabetical Index

Subject	Page No.
Introduction.....	3
Aircraft Boresight Requirements	4
Aircraft Preparation.....	4
Battery Replacement	14
Installation.....	15
Removal	15
General Instructions.....	3
Optical Alignment Set Verification Procedure	5

Alphabetical Index (Continued)

Subject	Page No.
Optical Alignment Set Preparation	5
Pitch and Yaw Alignment Verification	6
Roll Alignment Verification For INU and HUD Mounts	11
Roll Alignment Verification For Radar Antenna, FLIR, and LDT Mounts.....	8
Safety Precautions.....	4

Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
SEC 4998	—	Replacement of 74D110021 Triaxial Alignment Set With 537226 Optical Alignment Set. (Alameda ECP 775)	1 Jun 93	—

Support Equipment Required**Part Number or
Type Designation****Nomenclature**74D110163-1001
537226Boresight Alignment Set
Optical Alignment Set

Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
—	Camel Hair Brush

Materials Required

Specification or Part Number	Nomenclature
CCC-C-458 TYPE 3, CLASS 2	Cloth, Flannel
CCC-C-440 TYPE 1, CLASS 1	Cheesecloth
P-D-680, TYPE 2	Dry Cleaning Solvent

1. INTRODUCTION.

2. This work package contains organizational level maintenance instructions for performing and verifying alignment of 537226 Optical Alignment Set (OAS). The OAS is a subassembly of 74D110163-1001 boresight alignment set. Alignment is required in the pitch, yaw, and roll axes. The following procedures must be performed before using OAS to verify alignment of aircraft mounts.

3. **GENERAL INSTRUCTIONS.** To make sure aircraft mounts will be accurately boresighted, the instructions below shall be used:

a. Personnel must be familiar with the use and operation of the OAS.

- b. Personnel must know boresighting principles.
- c. Alignment verification and boresighting should be done separately from other maintenance operations.
- d. Mounting pads on OAS components shall be clean and free of burrs. Attach screws shall be clean and free of burrs and damaged threads.
- e. Visually inspect optical surfaces for scratches, surface contamination and physical damage.
- f. Visually inspect for loose or missing sealant around nuts on equipment.
- g. Visually inspect alignment set for corrosion, distortion, damage, and missing hardware.

4. SAFETY PRECAUTIONS.

- 5. Be sure landing gear aircraft ground safety pins are installed (A1-F18AC-PCM-000).

6. AIRCRAFT BORESIGHT REQUIREMENTS.

- 7. Aircraft structural flexing affects boresight accuracy. To control the effect of this flexing and to make sure the boresight is accurate, refer to the requirements listed in each specific WP for the mount selected for boresighting.

8. AIRCRAFT PREPARATION.

- 9. Make sure aircraft ground safety devices required during all ground operations are installed (A1-F18AC-PCM-000).

10. OPTICAL ALIGNMENT SET VERIFICATION PROCEDURE.**11. Optical Alignment Set Preparation.****CAUTION**

Optical surfaces are delicate and easily damaged by improper cleaning. To prevent damage, clean only when required. Do not rub excessively or use abrasive material for cleaning. Avoid touching optical surfaces with bare hands. Follow cleaning procedures carefully.

- a. Visually inspect optical surfaces on optical reference measurement unit, master reference mirror, and target mirror assembly. Clean optical surfaces, only if required, per substeps below:

- (1) Remove dust or loose foreign material from optical surfaces using clean camel-hair brush.

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- (2) Clean optical surfaces using clean flannel cloth moistened with dry cleaning solvent. Wipe in one direction only.

(3) Dry optical surfaces using clean, dry flannel cloth. Wipe in one direction only.

12. Pitch and Yaw Alignment Verification. See figure 1.**NOTE**

Pitch and yaw alignment of the OAS is done without mounting optical reference measurement unit (2) on the aircraft.

a. Install master reference mirror (1) on optical reference measurement unit (2) per substeps below:

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

(1) Clean attach points on master reference mirror (1) and attach points on optical reference measurement unit (2) using clean cheesecloth moistened with dry cleaning solvent. Make sure three attach screws (3) are clean and free of burrs and damaged threads.

(2) Position master reference mirror (1) on optical reference measurement unit (2) and install three attach screws (3) handtight.

b. Connect cable (5) to optical target monitor (4) and optical reference measurement unit (2).

- c. Connect power cable (6) to optical target monitor (4).
- d. Plug power cable (6) to electrical power source.
- e. Switch optical target monitor power switch (7) to ON.

NOTE

Pitch and yaw digital displays will indicate ERROR when batteries need replacement or if batteries are not installed.

- f. If pitch and yaw digital displays (17) and (18) indicate ERROR, do battery replacement procedures, this WP.
- g. Adjust focus control (19) as required for best focus of cross hairs.
- h. Adjust brightness control (20) as required for acceptable crosshair contrast, detail E.
- i. View video display (8) to verify crosshairs are centered on target rings. If required, adjust pitch and yaw micrometers (9) and (10) by rotating pitch and yaw micrometer spindles (11) and (12) to get centering of crosshairs on target rings.
- j. When crosshairs are properly centered, do substeps below:
 - (1) Push Zero Adjust buttons (13) and (14) on pitch and yaw micrometers (9) and (10). Verify micrometer digital readouts (15) and (16) change to zero.
 - (2) Switch optical target monitor power switch (7) to OFF.

(3) Loosen three attach screws (3) and remove master reference mirror (1) from optical reference measurement unit (2).

NOTE

Micrometer pitch and yaw digital readouts (15) and (16) should be the same as optical target monitor pitch and yaw digital displays (17) and (18) during all aircraft mount alignment procedures. If a difference in either pitch or yaw readings is noted, repeat pitch and yaw alignment verification procedure, this WP.

13. Roll Alignment Verification For Radar Antenna, FLIR, and LDT Mounts. See figure 2.

a. Set up and install BRFA (1) (WP009 00).

NOTE

Select a work area located near the radome that will allow viewing of optical target monitor (2) while adjustments are made.

b. Position optical target monitor (2) near work area.

c. Install optical reference measurement unit (3) and target mirror assembly (4) per substeps below:

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- (1) Clean attach points of optical reference measurement unit (3), target mirror assembly (4), ADSU roll reference pads (5), and radar alignment box (6) using clean cheesecloth moistened with dry cleaning solvent. Make sure three attach screws (7) are clean and free of burrs and damaged threads.
- (2) Position optical reference measurement unit (3) on radar alignment box (6) and install three attach screws (7) handtight.
- (3) Connect cable (8) to optical target monitor (2) and target mirror assembly (4).

NOTE

Make sure target mirror assembly is located on ADSU roll reference pads with cable connector facing inboard. This orientation is required to maintain correct phasing between optical reference measurement unit and target mirror roll sensors.

- (4) Position target mirror assembly (4) on ADSU roll reference pads (5) with cable connector facing inboard. Make sure target mirror base is aligned against pad locating pins.

- (5) Connect cable (9) to optical target monitor (2) and optical reference measurement unit (3).
- (6) Connect power cable (10) to optical target monitor (2).
- (7) Plug power cable (10) to electrical power source.
- (8) Switch optical target monitor power switch (11) to ON.

NOTE

Ignore pitch and yaw displays during roll alignment verification procedures. Do not make adjustments to micrometer spindles.

- (9) View roll digital display (13) on optical target monitor (2). Adjust roll-adjust zero potentiometer (12) to get roll reading of 0.00.
- (10) Lock potentiometer setting.
- (11) Switch optical target monitor power switch (11) to OFF.

d. Remove target mirror assembly (4) from ADSU roll reference pads (5).

e. Loosen three attach screws (7) and remove optical reference measurement unit (3) from radar alignment box (6).

f. Do applicable boresight procedure.

CAUTION

Batteries located in pitch and yaw micrometers should be removed after completion of aircraft boresighting. Damage to pitch and yaw micrometers may result from leakage of batteries.

14. Roll Alignment Verification For INU and HUD Mounts. See figure 3.

- a. Set up and install BRFA (1) (WP009 00).

NOTE

Select a work area located near the radome that will allow viewing of optical target monitor (2) while adjustments are made.

- b. Position optical target monitor (2) near work area.
- c. Install optical reference measurement unit (3) and target mirror assembly (4) per substeps below:

WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- (1) Clean attach points of optical reference measurement unit (3), target mirror assembly (4), ADSU roll reference pads (5), and inertial navigation unit alignment box (INU alignment box) (6) using clean cheesecloth moistened with dry cleaning solvent. Make sure three attach screws (7) are clean and free of burrs and damaged threads.
- (2) Position optical reference measurement unit (3) on INU alignment box (6) and install three attach screws (7) handtight.
- (3) Connect cable (8) to optical target monitor (2) and target mirror assembly (4).

NOTE

Make sure target mirror assembly is located on ADSU roll reference pads with cable connector facing outboard. This orientation is required to maintain correct phasing between optical reference measurement unit and target mirror roll sensors.

- (4) Position target mirror assembly (4) on ADSU roll reference pads (5) with cable connector facing outboard. Make sure target mirror base is aligned against pad locating pins.

- (5) Connect cable (9) to optical target monitor (2) and optical reference measurement unit (3).
- (6) Connect power cable (10) to optical target monitor (2).
- (7) Plug power cable (10) to electrical power source.
- (8) Switch optical target monitor power switch (11) to ON.

NOTE

Ignore pitch and yaw displays during roll alignment verification procedures. Do not make adjustments to micrometer spindles.

- (9) View roll digital display (13) on optical target monitor (2). Adjust roll-adjust zero potentiometer (12) to get roll reading of 0.00.
- (10) Lock potentiometer setting.
- (11) Switch optical target monitor power switch (11) to OFF.

- d. Remove target mirror assembly (4) from ADSU roll reference pads (5).
- e. Loosen three attach screws (7) and remove optical reference measurement unit (3) from INU alignment box (6).
- f. Do applicable boresight procedure.



Batteries located in pitch and yaw micrometers should be removed after completion of aircraft boresighting. Damage to pitch and yaw micrometers may result from leakage of batteries.

15. BATTERY REPLACEMENT. See figure 4.

16. Silver oxide batteries are used to power pitch and yaw micrometer digital readouts. The battery compartment is located on back side of pitch and yaw micrometers (1) and (2). Pitch and yaw digital displays (3) and (4) will indicate ERROR when batteries need replacement or if batteries are not installed.

Support Equipment Required

None

Materials Required**Specification
or Part Number****Nomenclature**

357

Battery, Silver Oxide
1.5 Volt

17. Removal.

- a. Remove battery cap (5) by rotating counterclockwise, detail D.
- b. Remove battery (6), detail E.

18. Installation.**NOTE**

Life of new battery under normal usage is approximately 6 months.

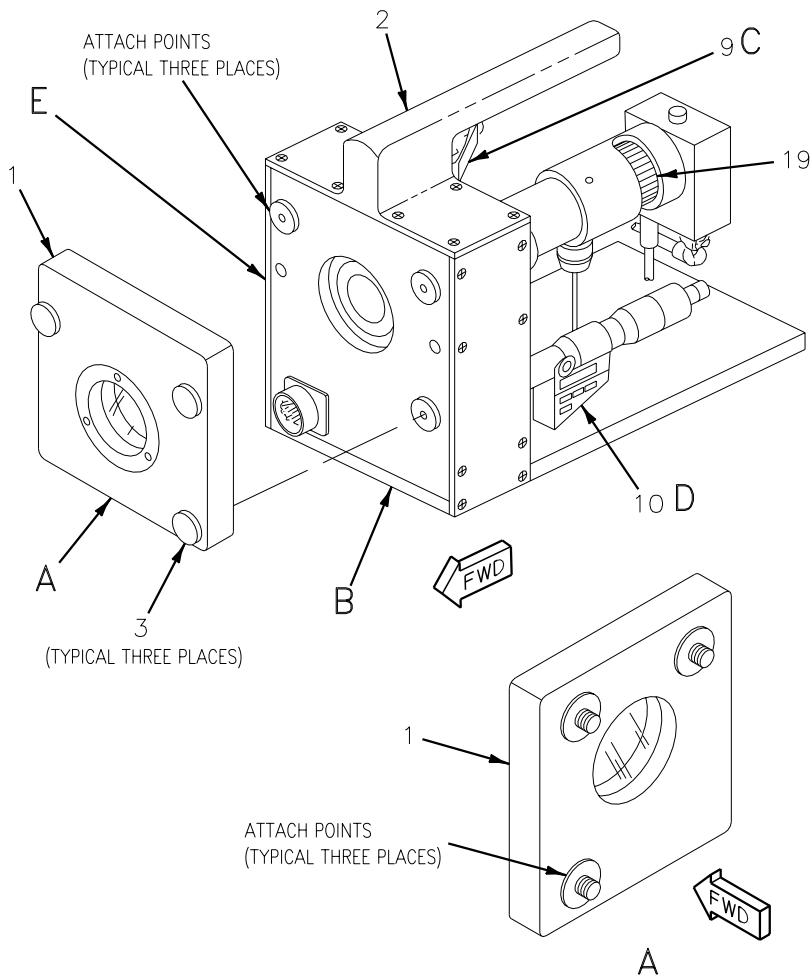
- a. Position battery (6) with positive side up and negative side down into battery compartment, detail E.
- b. Install battery cap (5) by rotating clockwise, detail F.

A1-F18AC-LMM-040

Change 3

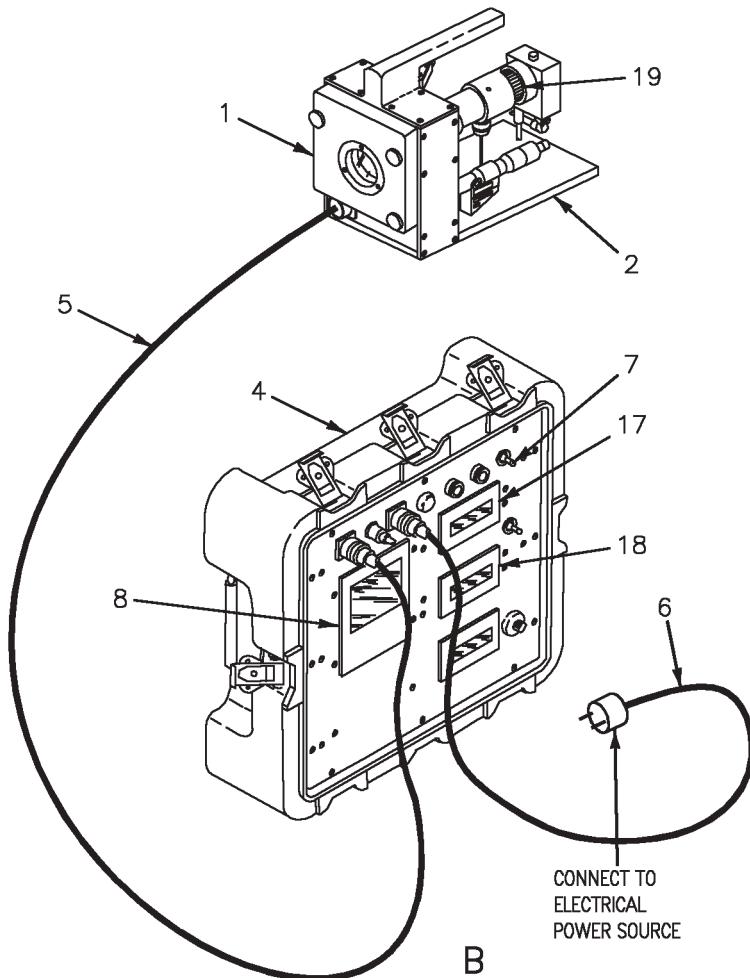
010 02

Page 16



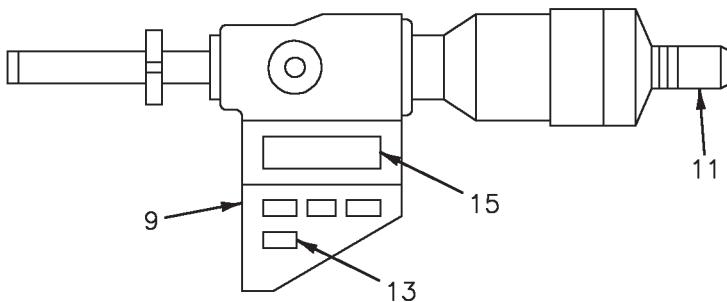
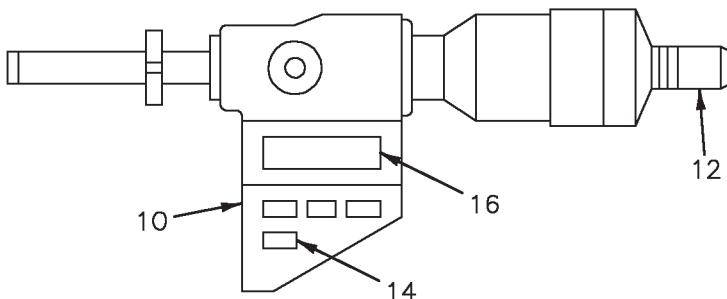
**Figure 1. Pitch and Yaw Alignment Verification
(Sheet 1)**

18AC-LMM-04-(12-1)14-CATI



**Figure 1. Pitch and Yaw Alignment Verification
(Sheet 2)**

18AC-LMM-04-(12-2)12-CATI

**PITCH MICROMETER****C****YAW MICROMETER****D**

18AC-LMM-04-(12-3)12-CATI

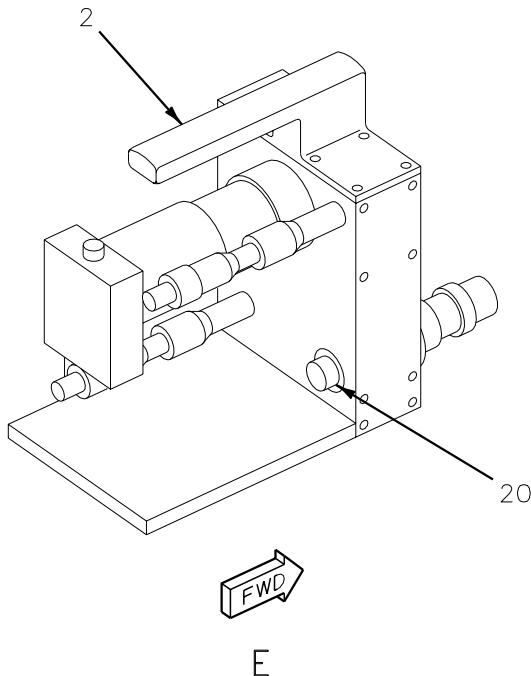
**Figure 1. Pitch and Yaw Alignment Verification
(Sheet 3)**

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Change 3

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18AC-LMM-04-(12-4)14-CATI

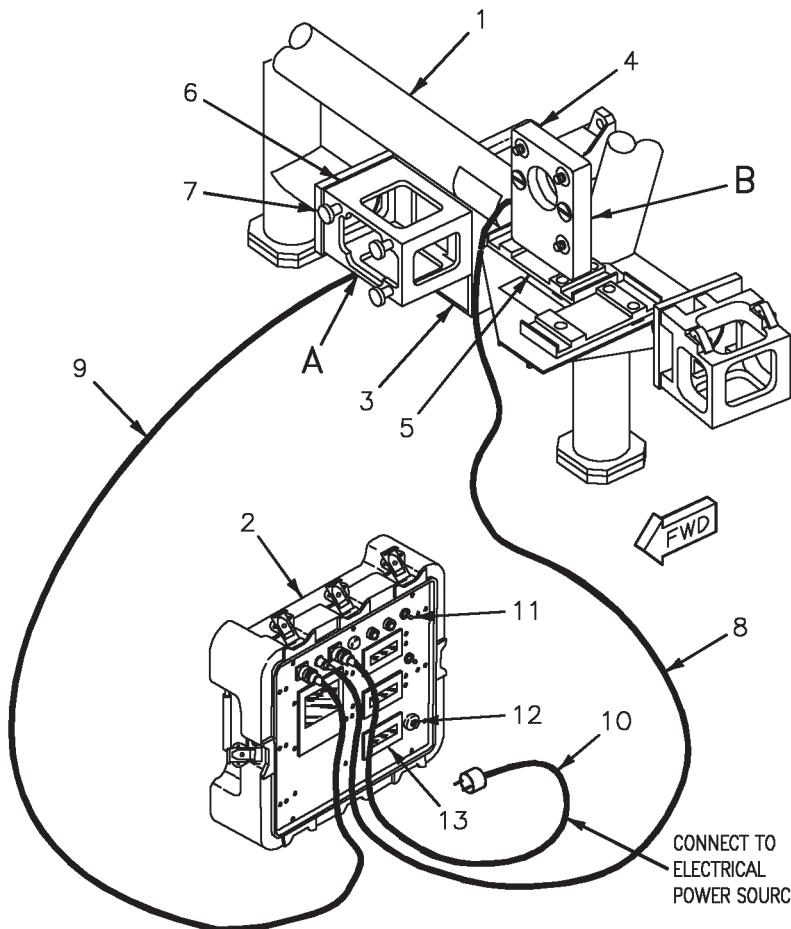
**Figure 1. Pitch and Yaw Alignment Verification
(Sheet 4)**

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1]▶	Master Reference Mirror	437229
2 [1]▶	Optical Reference Measurement Unit	537227
3	Attach Screws, Master Reference Mirror	—
4 [1]▶	Optical Target Monitor	437228
5 [1]▶	Cable	437230-2
6 [1]▶	Power Cable	437230-1
7	Power Switch	—
8	Video Display	—
9	Micrometer, Pitch	—
10	Micrometer, Yaw	—
11	Micrometer Spindle, Pitch	—
12	Micrometer Spindle, Yaw	—
13	Micrometer Zero Adjust Button, Pitch	—
14	Micrometer Zero Adjust Button, Yaw	—
15	Micrometer Digital Readout, Pitch	—
16	Micrometer Digital Readout, Yaw	—
17	Digital Display, Pitch	—
18	Digital Display, Yaw	—
19	Focus Control	—
20	Brightness Control	—

LEGEND

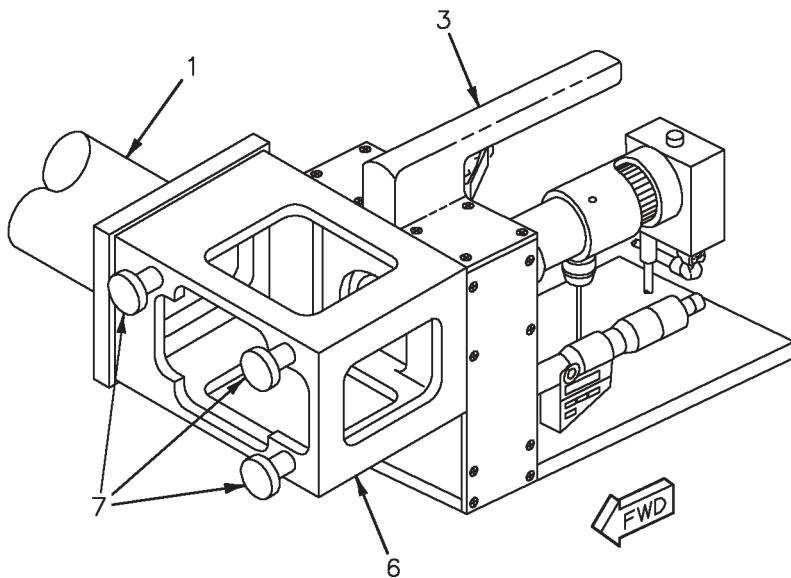
[1]▶ Part of 537226 optical alignment set.

**Figure 1. Pitch and Yaw Alignment Verification
(Sheet 5)**



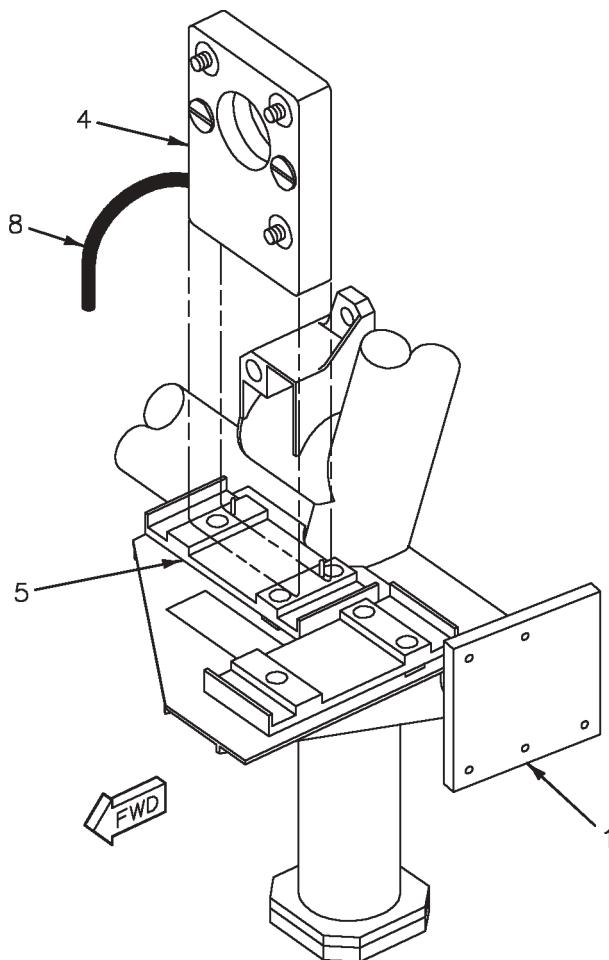
18AC-LMM-04-(20-1)12-CATI

**Figure 2. Roll Alignment Verification For Radar Antenna,
FLIR, and LDT Mounts (Sheet 1)**

**A**

18AC-LMM-04-(20-2)12-CATI

**Figure 2. Roll Alignment Verification For Radar Antenna,
FLIR, and LDT Mounts (Sheet 2)**

**B**

18AC-LMM-04-(20-3)12-CATI

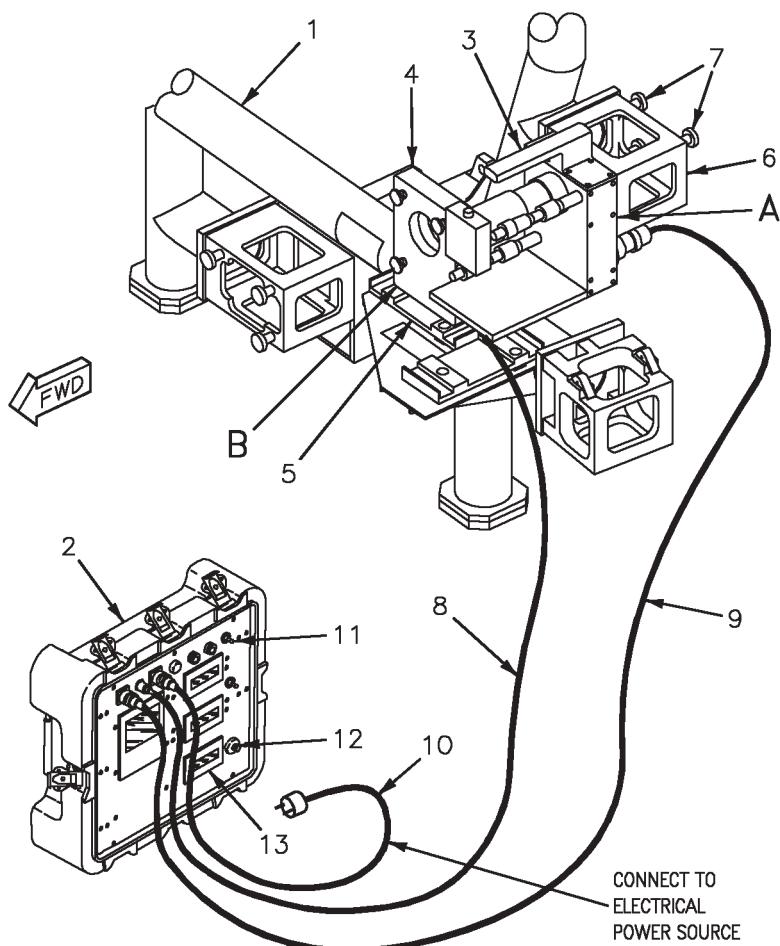
**Figure 2. Roll Alignment Verification For Radar Antenna,
FLIR, and LDT Mounts (Sheet 3)**

INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1] ◀	Boresight Reference Frame Assembly	74D111115
2 [2] ◀	Optical Target Monitor	437228
3 [2] ◀	Optical Reference Measurement Unit	537227
4 [2] ◀	Target Mirror Assembly	437232
5	Roll Reference Pads, ADSU	—
6	Alignment Box, Radar	—
7	Attach Screws, Radar Alignment Box	—
8 [2] ◀	Cable	437230-3
9 [2] ◀	Cable	437230-2
10 [2] ◀	Power Cable	437230-1
11	Power Switch	—
12	Roll-Adjust Zero Potentiometer	—
13	Digital Display, Roll	—

LEGEND

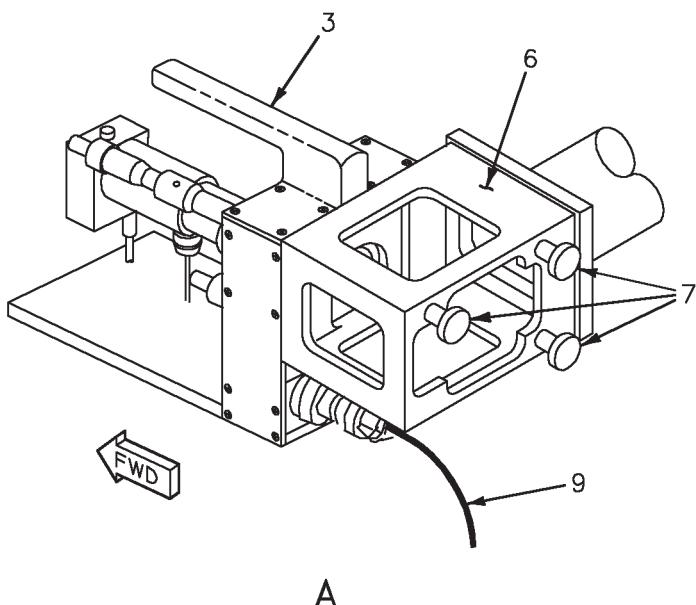
[1] ◀ Part of 74D110163 boresight alignment set.
[2] ◀ Part of 537226 optical alignment set.

**Figure 2. Roll Alignment Verification For Radar Antenna,
FLIR, and LDT Mounts (Sheet 4)**



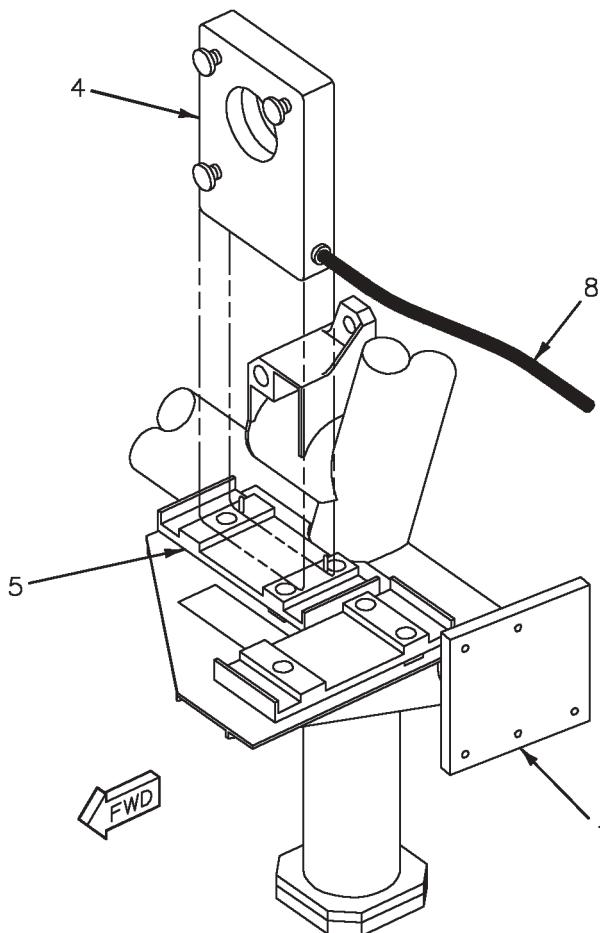
18AC-LMM-04-(21-1)12-CATI

**Figure 3. Roll Alignment Verification For
INU and HUD Mounts (Sheet 1)**



18AC-LMM-04-(21-2)12-CATI

**Figure 3. Roll Alignment Verification For
INU and HUD Mounts (Sheet 2)**

**B**

18AC-LMM-04-(21-3)12-CATI

**Figure 3. Roll Alignment Verification For
INU and HUD Mounts (Sheet 3)**

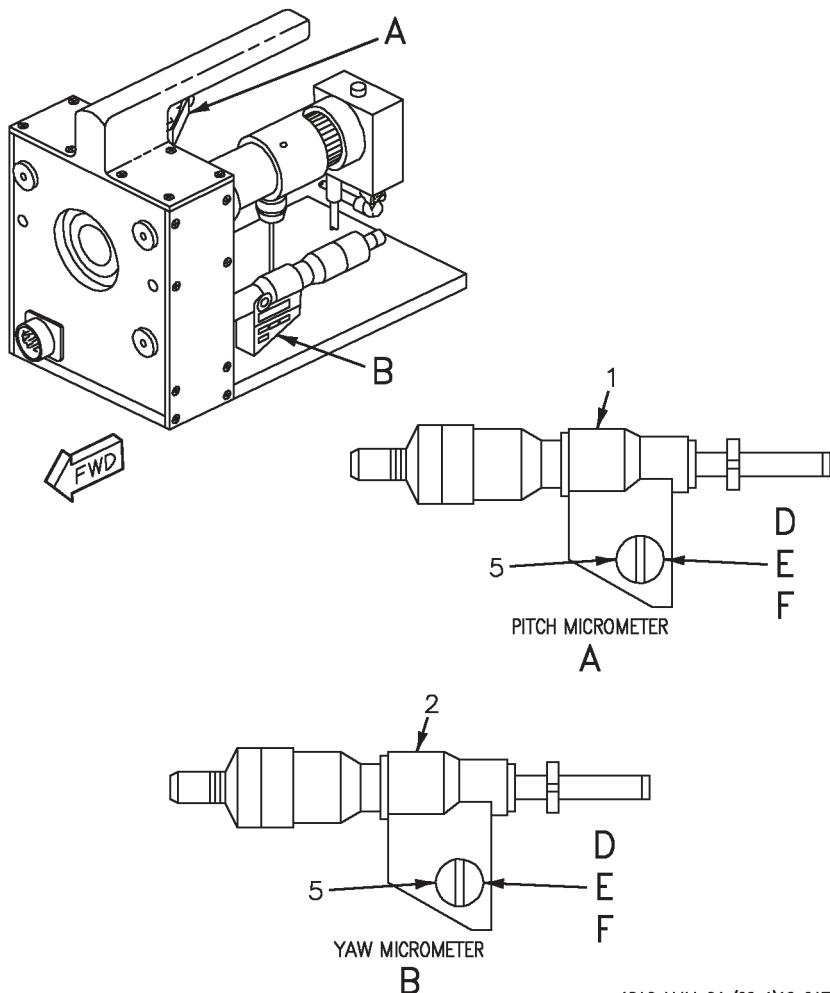
INDEX NO.	NOMENCLATURE	PART NUMBER
1 [1] ◀	Boresight Reference Frame Assembly	74D111115
2 [2] ◀	Optical Target Monitor	437228
3 [2] ◀	Optical Reference Measurement Unit	537227
4 [2] ◀	Target Mirror Assembly	437232
5	Roll Reference Pads, ADSU	—
6	Alignment Box, INU	—
7	Attach Screws, INU Alignment Box	—
8 [2] ◀	Cable	437230-3
9 [2] ◀	Cable	437230-2
10 [2] ◀	Power Cable	437230-1
11	Power Switch	—
12	Roll-Adjust Zero Potentiometer	—
13	Digital Display, Roll	—

LEGEND

[1] ◀ Part of 74D110163 boresight alignment set.

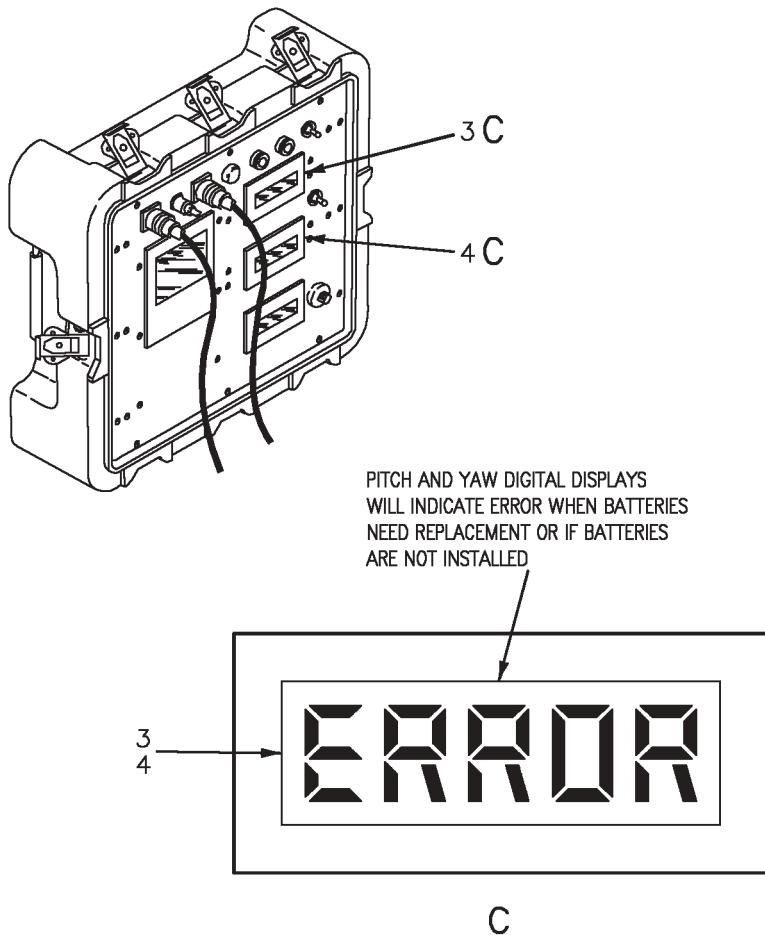
[2] ◀ Part of 537226 optical alignment set.

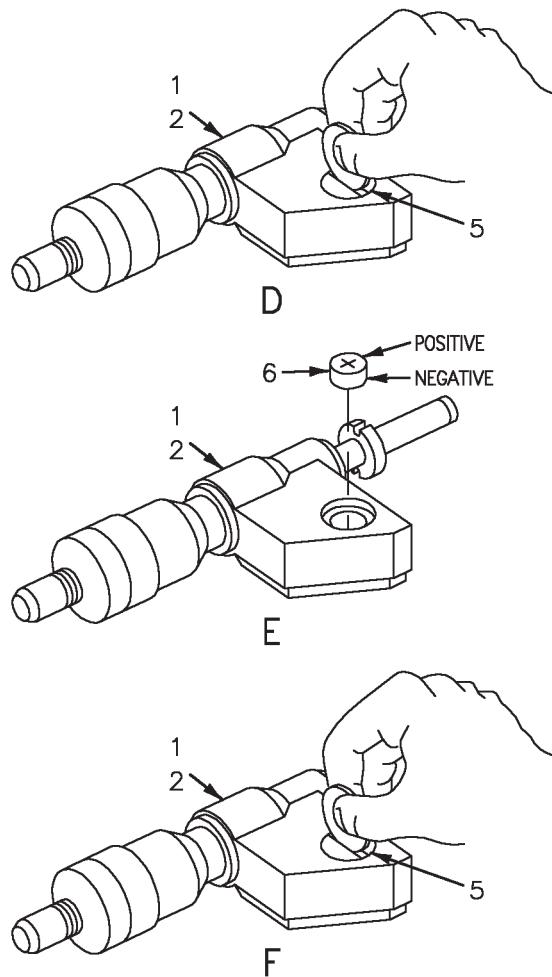
**Figure 3. Roll Alignment Verification For
INU and HUD Mounts (Sheet 4)**



18AC-LMM-04-(22-1)12-CATI

Figure 4. Battery Replacement (Sheet 1)





18AC-LMM-04-(22-3)12-CATI

Figure 4. Battery Replacement (Sheet 3)

A1-F18AC-LMM-040

Change 1

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INDEX NO.	NOMENCLATURE	PART NUMBER
1	Micrometer, Pitch	—
2	Micrometer, Yaw	—
3	Digital Display, Pitch	—
4	Digital Display, Yaw	—
5	Battery Cap	—
6	Battery	—

Figure 4. Battery Replacement (Sheet 4)

